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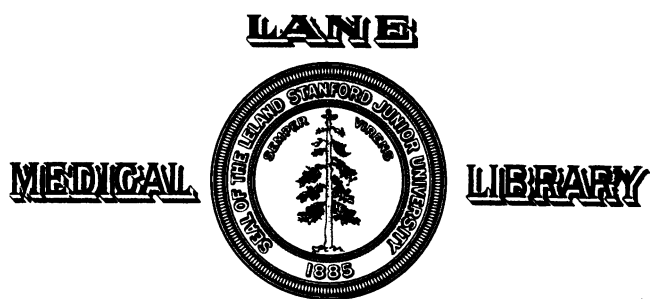
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MALIGNANT DISEASE OF THE
LARYNX

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MALIGNANT DISEASE

OF

THE LARYNX

(*CARCINOMA AND SARCOMA*)

BY

PHILIP R. W. DE SANTI, F.R.C.S.

SURGEON TO THE THROAT, NOSE AND EAR DEPARTMENTS, WESTMINSTER
HOSPITAL (LATE SENIOR ASSISTANT SURGEON, WESTMINSTER
HOSPITAL); LECTURER ON DISEASE OF THE THROAT, NOSE,
AND EAR, WESTMINSTER HOSPITAL MEDICAL SCHOOL

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PREFACE

It was originally intended that I should collaborate with my old teacher and friend Mr. Butlin in re-editing his monograph on 'Malignant Disease of the Larynx.' Unfortunately, owing to the great demands on Mr. Butlin's time, this arrangement has been found to be impracticable, and it has fallen to my lot to publish this treatise on my own responsibility.

It is with gratitude that I acknowledge the kindly help I have received in my task from Mr. Butlin and Sir Felix Semon, the two foremost authorities in this country on malignant disease of the larynx.

One of the main objects of this book is to place before the profession the views we hold in England as to the correct operative treatment of laryngeal cancer—views which have not so far been sufficiently understood or appreciated abroad.

If this treatise should contribute towards popularizing the operative treatment as practised so successfully in this country, I feel I shall not altogether have written in vain.

15, STRATFORD PLACE,
OXFORD STREET, W.
September, 1904.

MALIGNANT DISEASE OF THE LARYNX

HISTORY.

MALIGNANT disease appears to have been known in the earlier times; for instance, a case is recorded by Professor Boerhave, of Leyden (1668-1738), and Morgagni, of Padua, described the post-mortem appearances of a case of cancer of the pharynx and larynx in a man of fifty. Later, mention was made of cancerous affections of the larynx, but it was not until the discovery of the laryngoscope by Garcia in 1854* that any great advance in our knowledge of laryngeal carcinoma and sarcoma, and of its accurate diagnosis, became possible.

On December 31, 1873, the first complete extirpation of the larynx for cancer was performed by Billroth. Subsequently Schrötter, Morell Mackenzie, of London, and Fauvel, of Paris, paid particular attention to the subject, and especially good work was done by Krishaber, Eppinger, Cornil, and

* It is interesting to note that Señor Garcia is still alive and well, and celebrates his one-hundredth birthday next year.

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Ranvier, the two latter in pathological anatomy. In 1883 a monograph on 'Malignant Disease of the Larynx,' was published by Butlin, and since the illness and death of the German Emperor, Frederick III. (1887-1888), a very considerable amount of clinical, pathological, and operative work has been done in connection with these serious and far from uncommon affections of the larynx.

Malignant disease of the larynx presents itself in two forms—(1) *carcinoma*, (2) *sarcoma*. Each will be dealt with separately, commencing with that form which is infinitely the more common, namely, carcinoma.

CARCINOMA OF THE LARYNX.**ETIOLOGY.**

Of the nature of cancer of the larynx and of the general causes on which it depends nothing more is known than of the nature and etiology of cancer elsewhere, and this is, when said, but little and involved in obscurity.

Heredity does not seem to play any very marked rôle; indeed, of born or inherited predisposition to cancer of the larynx the evidence is distinctly negative, and curiously different to the inherited predisposition noticeable in cancer of other parts of the body, as of the breast or uterus. Nevertheless, there are cases on record with a distinct history of cancer in the family. Semon, out of 56 cases under his own personal observation, records 3 in which heredity played a part. In 1 case the father of the patient suffering from laryngeal carcinoma died from malignant tumour of the throat; in another two sisters of the patient died, one from cancer of the uterus, the other from cancer of the breast; in his third case the heredity was of a more distant nature.

Bailly and Isambert have recorded a case in which the father of the affected patient died of cancer of the pylorus and the sister of cancer of the uterus.

Other similar records exist, and have been noted by Krishaber, Baratoux, Schmidt, etc., but whilst

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admitting that a family history of cancer in persons suffering from laryngeal cancer occasionally exists, it has been of rare occurrence.

Chronic Irritation.—There seem to be fair grounds for stating that chronic irritation is a predisposing cause, and this is only in accordance with the knowledge we have of chronic irritation producing carcinoma elsewhere—for instance, the lip from smoking, the scrotum from soot (chimney-sweeps).

Excesses in alcohol and tobacco and overuse of the voice have been considered predisposing causes, but certainly, as regards overuse of the voice, clergymen, singers, and lawyers do not seem more liable to the affection than other people. Nevertheless, on investigation of the histories of some of the patients suffering from this disease, it is noticeable that they have attributed their laryngeal trouble to excessive use of the voice, one man in particular ascribing his malady to loud shouting in a sawmill, of which he was manager.

I have certainly seen myself one case of epithelioma of the larynx follow chronic laryngitis produced by alcohol and abuse of tobacco. In this case there was present the condition described by Virchow as 'pachydermia laryngis,' epithelioma supervening.

Many of the patients under Butlin's care believed that a severe cold was the cause of the formation of tumour, for in several cases the first symptoms of disease were hoarseness and slight cough. But it is almost certain that these symptoms of laryngeal irritation were the early symptoms of the tumour. They did not pass off or generally become less

marked even for a time, but in most instances persisted, and gradually became more urgent. A few of the patients, however, appear really to have suffered from a severe cold, for they were able to assign the precise date of its occurrence, and the symptoms of the tumour commenced during the period of chronic catarrh.

Syphilitic and tubercular lesions of the larynx are important in so far as that they may lead to carcinoma by virtue of the local irritation they set up.

Lépine and Krishaber have recorded cases in which both tubercle and cancer of the larynx were present in the same patient.

Semon also has seen cancer of the larynx associated with tuberculosis of the lungs.

The assertion that there is a special liability to transformation of simple benign tumours of the larynx into malignant tumours after repeated endolaryngeal operations has been conclusively shown by Semon's exhaustive collective investigation to be unfounded.

In 8,216 cases of intralaryngeal operation there were only 5 cases in which such a transformation undoubtedly took place, a proportion of 1 in 1,645.

In 7 further cases the transformation, although not certain, was probable, and in another 10 doubtful. If these cases be included in addition to the certain ones, the proportion of cases in which a benign laryngeal growth underwent malignant degeneration after endolaryngeal operation would be as 1 in 373, whilst if the certain and probable cases only were admitted, as 1 in 685.

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As playing a very small part in the etiology of carcinoma laryngis, reference may be made to contagion and autoinfection. There are a few cases published bearing on these two cases, but the cases are so few that no more need be said on the subject.

Age.—All authors agree that carcinoma of the larynx is most frequently met with between the ages of 40 and 70, and that of these 30 years, the decade 50 to 60 is the one in which cancer predominates.

In Butlin's monograph the following table is given of the ages of 50 patients :

Years.	Cases.
3 - - - - -	1
28 to 30 - - - - -	4
31 to 40 - - - - -	6
41 to 50 - - - - -	8
51 to 60 - - - - -	15
61 to 70 - - - - -	10
71 to 76 - - - - -	2
Uncertain - - - - -	4
Total - - - - -	50

It will be seen that there is only one patient under 28 years of age, and that patient, strange to say, was a boy of 3 years, whose case is recorded by Dr. Rehn.* The disease began with symptoms of hoarseness, which passed on to loss of voice, and later produced attacks of suffocation. It was thought to have existed for at least two years. During one of the attacks of suffocation the patient died, although tracheotomy was performed for his relief. Both cords, the ventricles and ventricular bands, and the epiglottis, were the seat of a whitish-red, warty,

* *Virchow's Archiv*, Bd. xliii., S. 129, 1868.

cauliflower mass, which appeared to have originated in the ventricles. Thus far the disease might be regarded rather as a papilloma than an epithelioma, but the diagnosis rested on the three following circumstances: the tumour grew almost down to the perichondrium of the thyroid cartilage; the microscopical examination made by Virchow discovered the ordinary structure of epithelioma, with solid plugs of epithelium dipping down into the muscles and other deeply-seated tissues; and there was one enlarged lymphatic gland at the inner border of the sterno-mastoid muscle. In the face of these conditions the disease can scarcely be considered other than epithelioma occurring at a marvellously early age. With this exception the table of ages corresponds with that of epithelioma of the tongue, the lip, and other parts, save that the number of cases between 28 and 30 is unusually large.

Dufour has recorded a case in a still younger patient, a child of 1 year of age.

Sendziak's table of 486 cases of cancer of the larynx collected from various sources gives the following results:

	Years.		Cases.
Between	1 and 20	- - -	5
„	20 and 30	- - -	22
„	30 and 40	- - -	41
„	40 and 50	- - -	121
„	50 and 60	- - -	188
„	60 and 70	- - -	80
„	70 and 80	- - -	17
„	80 and 90	- - -	5
Cases in which the age was not stated			- 7
Total			- 486

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Between the ages of 40 to 70 there were, therefore, 389 cases, more than 84 per cent. of the whole number. These results agree with those of Semon. He gives 103 cases, 87 of which occurred between the ages of 40 to 70, again more than 84 per cent.

The tables of Baratoux and others support these results.

The age of the oldest patient in which cancer of the larynx has been recorded is 83 (Semon), and next to this patient a man of 82 (Preisendorffer).

Sex.—The much greater liability of males than females to cancer of the larynx has been noticed by most writers. Of the 50 patients already referred to, 40 were males and 10 were females. Out of Sendziak's 486 cases, 400 were males, 68 females, and in 18 there is no mention of the sex.

Schwartz noted 153 males and 26 females. Baratoux's statistics give 265 males and only 36 females. Semon notes 79 males and 24 females. Jurasz in 21 cases of cancer of the larynx mentions only 1 as being of the female sex.

There seem to be no satisfactory reasons to explain the differences in the liability of the sexes to carcinoma of the larynx. In dealing with the occupations and habits of the patients as etiological factors, it has been pointed out that there is nothing which leads one to suppose that either occupation or habit predisposed to the disease in any appreciable number of cases.

Fauvel has suggested that the larynx is much more liable to innocent and malignant tumours in men than women because these diseases find in

women a soil, as it were, prepared for them in the breasts and uterus ('Physiological Activity and Decline').

Schiffers* has gone further than Fauvel by supposing that cancer plays in the larynx in the male the rôle which it plays in the uterus in the female. He speaks of the sympathy which exists between the larynx and the uterus at puberty, and of their reciprocal influence.

Dr. Schiffers seems to be unaware of the fact that the lower lip, the tongue, and the œsophagus are all more frequently attacked by cancer in men than women, and that the disproportion is greatest in cancer of the lower lip.

It is also a curious fact that in women the extrinsic form, in men the intrinsic, is much more common.

PATHOLOGICAL ANATOMY.

In considering both sarcoma and carcinoma of the larynx, the division suggested by Krishaber into tumours of *intrinsic* and *extrinsic* origin has been hitherto that most universally adopted, for it appears to be not merely convenient for purposes of classification, but is considered valuable in relation to the subject of secondary infection of the lymphatic glands.

The term *intrinsic* is applied to tumours which arise in connection with the vocal cords, the ventricles, the false vocal cords, and the parts immediately below the true vocal cords; the term *extrinsic* to

* *Rev. Mens. de Laryng.*, vol. iv., p. 16, 1883.

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those tumours which grow from the epiglottis, the aryepiglottic folds, the interarytenoid folds, etc.

The question of the affection of the lymphatic glands is one whose importance it is difficult to overestimate. In 1879* Krishaber laid down the general rule that the extrinsic cancers affect the glands at an early period, and that the intrinsic cancers, so long as they are limited to the cavity of the larynx, do not affect the glands.

Schwartz uses the terms 'cavitaires et marginaux' (of the interior, and of the borders of the larynx). Recently Cunéo† suggested the abandonment of Krishaber's division into intrinsic and extrinsic carcinomas, and the substitution of a division into supraglottic, infraglottic, and glottic carcinomas, basing this division on his anatomical researches of the laryngeal lymphatic system.

In my opinion, no sufficient grounds have been adduced for abandoning Krishaber's classification, which in the main, as regards infection of the glands, remains true to the present time.

The following account of the lymphatic system is important in relation to the almost universal adoption of Krishaber's classification and the deductions made by him as to secondary lymphatic infection.

Lymphatics of the Larynx.

Apparently the first accurate description of the laryngeal lymphatics was published by Teichmann,

* Krishaber, 'Annales de Laryngol.', 1879.

† *Gazette des Hôpitaux*, No. 141, 1902.

who laid particular stress on the distribution of the terminal vessels in the mucous membrane of the larynx. In 1871 Luschka published his excellent work on the lymphatic system, and in 1874 Sappey* completed the description of these vessels, and gave an account of the general arrangement of the lymphatic radicles and their final distribution to the lymphatic glands. In 1887† Poirier injected the lymphatics of the inferior true vocal cords, the existence of which had up till then been contested, and drew attention again to the pre-laryngeal glands referred to by Engel in 1859, but which had not been recognised by writers since.

In 1899‡ Most investigated the laryngeal lymphatics, and for his investigation employed the method of Gerota, and recently§ Cunéo published an article giving his results obtained by injecting several larynges in the same manner as Most, and corroborating Most's results. I have also employed Gerota's method, and find the results agree in the main with Cunéo's.

The following account of the lymphatic laryngeal system is as given by Cunéo, and confirmed by my own injections, except where specifically found to differ.

* 'Anatomie, Physiologie, Pathologie des Vaisseaux Lymphatiques.' Paris, 1874.

† 'Vaisseaux Lymphatiques du Larynx: Ganglion Pré-laryngé,' *Progrès Méd.*, 1887, No. 19, p. 373.

‡ *Anat. Anz.*, 1899, p. 387, and *Zeitschr. f. Chir.*, Bd. lvii., 1900.

§ *Gazette des Hôpitaux*, No. 141, 1902.

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The Lymphatic Radicles.—The lymphatics of the larynx take their origin in a network that covers the whole of the internal surface of the larynx, and is densest where the mucous membrane is thickest, but divisible into two areas, an upper and a lower area.

The upper area in which the terminal network is in greater part very dense, and quite easy to inject, includes all the portion of the laryngeal mucous membrane above the glottis, namely the epiglottis, aryteno-epiglottidean folds, superior vocal cords, and the ventricles.

The inferior area includes the mucous membrane of the larynx below the glottis. At this level the network is decidedly less dense, and in all cases less easy to inject than that of the upper area.

These two areas are relatively independent of one another. They are, as a matter of fact, separated by an intermediary zone, formed by the inferior vocal cords, at which level the lymphatic radicles are even more rare and attenuated, though not entirely absent.

At the level of the posterior aspect of the larynx the two areas extend without any very clear line of demarcation. If an injection at the level of the inferior vocal cord be pushed, the material injected usually enters, according to Most, the vessels of the upper area.

It is of importance to note that the lymphatics of one half of the larynx do not communicate with those of the opposite side anteriorly, but that at the level of the posterior median line the intercommuni-

cations are very numerous. The network of the lower area is directly continuous with the tracheal network, there being no line of demarcation at all. Similarly the network of the upper area is directly continuous with the network covering the mucous membrane of the pharynx and base of the tongue.

All these facts are of great importance from the point of view of the local spread of laryngeal cancer.

Distribution of the Lymphatic Channels arising from the Lymphatic Radicles.

Each of the two areas have a distinct set of efferent vessels.

The trunks arising from the upper meshwork run towards the lateral parts of the epiglottis and aryepiglottic folds, and then pierce the thyro-hyoid membrane at the point of entry of the superior laryngeal artery.

After piercing the thyro-hyoid membrane, these collecting trunks divide into three sets, an ascending group of one or two in number, which cross the hypoglossal nerve and end in a gland situated just below the posterior belly of the digastric muscle, a horizontal group emptying into the glands placed on the internal jugular vein at the level of the bifurcation of the common carotid, and a descending group ending in glands of the same chain at a level of the middle part of the lateral lobes of the thyroid gland.

Occasionally one or two small glands are found on the thyro-hyoid membrane itself, but they do not, when present, receive lymphatics from the larynx ;

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their lymphatics come from the lateral regions of the pharynx.

The trunks arising from the lower meshwork are divisible into two groups, one anterior, the other posterior.

The anterior group (supracricoid) consists of three or four trunks, which perforate the crico-thyroid membrane near the middle line. Some of these trunks end in the pre-laryngeal glands (Poirier), others in a pre-tracheal gland (Most), and others in one of the glands of the middle or inferior sterno-mastoid chain of glands.

The pre-laryngeal and pre-tracheal glands form (Poirier-Charpy, t. xi., p. 1280) part of a chain described as the deep cervical chain.

This chain consists, according to Poirier, of three distinct groups or masses of glands.

(1) A *pre-laryngeal* mass, first noted by Engel. Its existence has been confirmed by Poirier, he finding the pre-laryngeal group present 49 times out of 100. Usually only one gland is present, which in the adult is about the size of a pea, and tends to atrophy in old age. It is generally found in the middle of the V-shaped space formed by the two crico-thyroid muscles, although occasionally it is overlapped by the inner border of one of these muscles.

In 1 out of 6 cases a second gland about the size of a pin's head has been found at the level of the top of the V-shaped space.

Sometimes a gland has been found on the upper edge of the isthmus of the thyroid (Mascagni, Rou-

band, Most), and occasionally a gland in front of the thyroid cartilage close to its anterior border.

(2) A *pre-thyroidean* mass, placed in front of the isthmus of the thyroid. This group is only rarely present.

(3) A *pre-tracheal* mass, usually consisting of one gland of the size of a small pea, and situated about $1\frac{1}{2}$ centimetres above the sternal notch.

There may, however, be more than one pre-tracheal gland. The afferent vessels of the pre-laryngeal glands are some of the lymphatics of the middle lymphatic pedicle of the larynx and those of the pre-tracheal come partly from the thyroid body, partly from the pre-laryngeal glands.

The efferent vessels from the pre-laryngeal, pre-thyroidean, and pre-tracheal glands empty themselves into the lowermost glands of the sterno-mastoid chain.

The posterior or infracricoid group consists of three to five trunks, which pass over the crico-tracheal membrane at the junction of the lateral and posterior aspects of the trachea.

These trunks end in two to five glands running parallel with the recurrent laryngeal nerve. These glands collect vessels from the thyroid body, the lymphatics of the inferior pedicle of the larynx, and the vessels from the cervical portion of the trachea and oesophagus.

Their efferent vessels end in the lowermost glands of the sterno-mastoid chain and the supraclavicular glands. To sum up, the lymphatic channels emanating from the larynx empty themselves into the glands

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situated beneath the sterno-mastoid muscles into the pre-laryngo-tracheal glands and into the glands accompanying the recurrent laryngeal nerves, and additionally into the supra clavicular glands.

The group of glands underneath the sterno-mastoid muscles must be looked upon as the principal group of glands to finally receive the lymphatics of the larynx. The pre-laryngeal, pre-tracheal, and recurrent groups are only simple glandular points placed as interrupters on the line of the lymphatic vessels going from the subglottic area to the deeper group of sterno-mastoid glands (Cunéo).

Application of these Anatomical Facts to the Extension of Epithelioma of the Larynx by the Lymphatics.

Extrinsic carcinoma includes several varieties—cancer of the epiglottis (very frequent), of the ary-epiglottic folds (less frequent), and of the arytenoid region (rare).

These differently-placed carcinomas all present common characteristics. They tend to push themselves towards the upper opening of the larynx, and to invade the lateral regions of the larynx and pharynx.

Whilst extrinsic carcinoma reaches the final stage of its evolution by invading the extra-laryngeal parts, it is at the level of the posterior aspect of the thyroid membrane that these extensions are liable to become visible, namely, to ulcerate through.

Extrinsic carcinoma in its downward growth tends to become arrested at the level of the inferior vocal cords. This has been noted by several observers, yet, at the same time, it must not be understood that the inferior vocal cords form an absolutely impassable barrier, only that they seem, at all events, to arrest its extension for some length of time.

Intrinsic carcinoma includes cancer affecting the superior false vocal cords, the ventricles, the true vocal cords, and the parts immediately below the true vocal cords (subglottic region). The true vocal cords are most frequently the initial seat of laryngeal carcinoma, although some observers are of opinion that the false vocal cords are most frequently affected. The statistics of Sendziak show the true vocal cords to have been the seat of disease in 107 cases, whereas the false vocal cords were affected in only 27. Semon, again, out of 55 cases, notes the true vocal cords as affected in 15 cases and the false in 3 only. On the other hand, Baratoux, out of 117 cases, noted 62 that were primary in the false vocal cords against 29 in the true vocal cords, and Fauvel, out of 37 cases, records only 1 in which the true vocal cords were the primary seat of disease.

Carcinoma of the true or false vocal cords is conspicuous by virtue of the slowness of its evolution, particularly so when the true vocal cord is the initial seat of disease.

According to some authorities, carcinoma of the true vocal cord has a tendency to extend at first towards the opposite cord, then towards the supra-glottic region. It is, however, in the majority of

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cases impossible to tell in what direction the growth will spread, cases being very dissimilar in this respect. At the same time, in my experience there is a tendency for carcinoma attacking the true or false vocal cords to spread towards the supraglottic region.

Subglottic carcinoma is rare. Out of 486 cases of laryngeal cancer, Sendziak only collected 5. Out of 50 cases collected by Butlin in his monograph on 'Malignant Disease of the Larynx,' 5 were infraglottic, in every case situated immediately below the vocal cord. A case of this kind was published in the *New York Medical Record* by Dr. Delavan,* who regarded the situation of the tumour as unique. But a similar case is recorded by Émile Blanc,† a third case by Krishaber,‡ and a fourth by Norton.§ The close resemblance of this case to that recorded by Dr. Delavan is very striking. In neither was there a visible tumour; in both the vocal cord was paralyzed and a little thrust up by the tumour. In neither was there any affection of the glands or of any of the other organs or tissues. In Blanc's case the tumour was visible between the vocal cords, and the tumour could also be seen in Krishaber's case.

The fifth of the series occurred in St. Bartholomew's Hospital in a man fifty-six years old, who had suffered from laryngeal trouble, slight hoarseness and cough, with severe attacks of dyspnoea, for

* *New York Medical Record*, vol. xx., p. 625, 1881.

† *Loc. cit.*, p. 46, obs. 2.

‡ *Gaz. Hebdom.*, p. 540, 1879.

§ *Path. Trans.*, vol. xxiii., p. 43, 1872.

several months. One of the vocal cords was observed to be paralyzed, but no tumour could be discovered. His symptoms were ascribed to various causes, among others to aneurism of the aorta, and to affection of the recurrent laryngeal nerve; and it was not until after his death, which took place from apnœa, that the real nature of the malady was made apparent.

A tumour the size of a hazel-nut lay immediately below the right vocal cord, partly embedded in the wall of the larynx. It had perforated the alæ of the thyroid cartilage, and produced a very small collection of matter on the outer surface of the larynx. The swelling had not been perceptible through the tissues over the thyroid cartilage, nor was there any enlargement of the lymphatic glands from which a clue to the nature of the disease might have been derived. The tumour was an admirable specimen of squamous-celled carcinoma.

Subglottic carcinomas tend to invade the trachea, and have been noticed to become arrested in their growth for a time when reaching the level of the inferior true vocal cords. In a case observed by Cunéo, the true vocal cords were invaded, but the supraglottic area was quite free.

Whatever may be the original site of origin of a laryngeal carcinoma, it tends to remain limited at its commencement to one-half of the larynx; only carcinoma of the epiglottis and of the arytenoid region are exceptions to this rule. This limitation is of considerable importance in connection with operative interference. It often permits of a partial instead of a total laryngectomy, with a smaller death-

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rate and a better chance of restitution of the functions of the organ.

This limitation to one-half is, however, merely temporary; sooner or later the neoplasm tends to attack the opposite side. In a few cases the opposite side has become affected by contact, but usually it is by direct continuous invasion. This most often occurs at the level of the posterior aspect of the larynx, although it has been observed to invade the opposite cord through the anterior commissure (B. Fraenkel, Semon).

To sum up, *extrinsic* carcinomas tend to grow towards the superior orifice of the larynx, and often cease to extend when they reach the level of the glottis. *Intrinsic* carcinomas, if above the glottis, also tend to spread towards the superior orifice of the larynx, but remain localized much longer than extrinsic carcinomas, especially so when the true vocal cords are primarily attacked; if below the glottis, they tend to spread towards the trachea.

Finally, with the exception of cancers of the epiglottis and arytenoid region, laryngeal cancers remain localized for a period more or less long. These rules are by no means absolute; there are many exceptions; still, they are applicable to the majority of cases.

It is easy to see that the distribution of the lymphatics can to a great extent explain these different particulars in the local extension of malignant disease of the larynx.

The arrest for a long time of growths reaching to the inferior vocal cords is the result of the attenua-

tion and diminution in number of the lymphatics at this point.

In extending towards the superior laryngeal orifice, extrinsic epitheliomas only obey the general law observable in the extension of all epitheliomas—namely, a preference to follow the course of the lymphatic current.

Extension of epithelioma of the epiglottis to the base of the tongue finds an easy explanation in the connection of the lingual lymphatic vessels with those originating from the anterior surface of the epiglottis.

Moreover, the continuity of the subglottic meshwork with that of the trachea gives the clue to the relative facility with which subglottic epithelioma descends towards the trachea. The paucity in number of the lymphatics, although slight as regards the superior vocal cords, but very marked at the level of the inferior vocal cords, is certainly one of the factors determining the slow evolution of epithelioma developing in these regions. Another factor worthy of note, in my opinion, is the tendency to atrophy of these lymphatic radicles as old age approaches. It is certainly increasingly difficult to make a thorough injection of the laryngeal lymphatics the older the patient on whom the injection is practised; in very young children an injection is much more easy to make and extensive in nature.

Finally, the abstention of involvement of the opposite side of the larynx for a more or less lengthy period is due to the relative independence of the lymphatics of each half of the larynx.

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Like all epitheliomas, cancer of the larynx tends eventually to invade the lymphatic glands. This implication is the rule in late cases; it is generally particularly well marked in those cases in which a palliative tracheotomy has been performed, and in which the disease is too extensive for operative interference.

It is decidedly rare to find cases in which the whole of the interior of the larynx has been destroyed by epithelioma without there being the slightest glandular infection. A good example of such a case, however, is given by Most.

Glandular infection is, however, undoubtedly rare if the growth be of intrinsic origin and limited in size, especially so if attacking the anterior two-thirds of the true vocal cords.

Schleier* has noted it 20 times only out of 125 cases; Sendziak, 54 out of 486 cases. Other authors, however, give a much higher percentage. Jurasz,† 9 out of 21 cases; Schwartz, 13 out of 28. All these statistics have only a relative value; they are, as Cunéo points out, based on clinical observations, which are often fallacious. Absence of enlarged glands to palpation does not prove their being free from infection. Madelung, Salzer,‡ etc., have found cancerous cells in glands which had retained their normal size and appearance.

Again, glandular enlargement in a case of laryngeal carcinoma does not necessarily mean malignant

* *Deuts. Med. Wochens.*, 1888.

† Heymann's 'Handbuch,' vol. i., p. 885.

‡ Salzer, *Arch. f. Klin. Chir.*, 1885, Bd. xxxi.

infection. Such enlargement may be due to septic infection from a septic cancerous ulcer, or be independent of the cancer and due to some simple septic lesion of the tonsils or pharynx.

Satisfactory statistics as to glandular infection can only really be arrived at by thorough microscopic examination of the glands in each and every case removed at the same time as the laryngeal cancer, both ante- and post-mortem. Nevertheless, the broad clinical fact remains that in certain cases of laryngeal carcinoma involvement of the glands is certain and early, in others uncertain and late.

Several causes, according to Cunéo, have been brought forward to explain the early immunity of the glands.

First of all, the major number of laryngeal cancers are squamous-celled epitheliomata (248 out of 486 cases, Sendziak), and it is stated by Cunéo that this variety of growth generally attacks the glands somewhat late. This, however, cannot be held to be correct, for in epithelioma attacking the tongue or tonsil very early and extensive implication of the glands is the rule.

Secondly, the same authority holds the opinion that cancer of the larynx tends frequently to become pedunculated, and to grow into the cavity of the larynx without extending much beyond the border of its base of origin, and that these pedunculated cancers growing into a cavity do not as a rule invade the glands until a very late stage, a good example being papillary carcinoma of the bladder.

Whilst admitting that a laryngeal carcinoma may

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become pedunculated, such an occurrence is decidedly uncommon; the general rule is to find a sessile growth with early infiltration of the parts at its base of origin.

Finally, if certain parts of the larynx, such as the aryteno-epiglottidean folds and epiglottis, are very rich in lymphatics, it is seen that in other parts, such as the subglottic area, the lymphatic meshwork is much less developed, and that on the true vocal cords, one of the sites of election for epithelioma, the lymphatics are so few in number that their injection is a matter of considerable difficulty.

Is it not probable that the more or less tardy appearance of glandular infection is intimately connected with the site of origin of a laryngeal cancer?

'As long as the cancer remains intrinsic,' says Krishaber, 'there is no cervical glandular enlargement; when it is extrinsic the glands are infected.'

This statement, although too absolute, is borne out by general experience.

Cunéo considers Krishaber's classification inconvenient, in that it includes under the same heading varieties behaving, as regards glandular infection, in very different ways. Cunéo states: 'One would have to admit that epitheliomas attacking the superior vocal cords, which are rich in lymphatics, involve the glands equally late as in epithelioma attacking the inferior vocal cords, the lymphatics of which are extremely few and ill-developed.' He goes on to state that he has seen and collected other cases showing that glandular infection occurs early

when the superior vocal cords are the site of origin of laryngeal cancer.

In describing the anatomy of the laryngeal lymphatics, I have stated that, in the main, the results of my injections were identical with those of Cunéo; yet, as regards the richness of the lymphatic network in the region of the superior vocal cords, I did not find myself in agreement with him. I found there was a distinct tendency in a supraglottic injection for the lymphatic system, as it invaded the superior vocal cords, to become altered; though the lymphatic radicles traversed the superior cords, still, they were found to become more and more attenuated as they reached their free border. In fact, the region of the superior vocal cords was distinctly less rich in lymphatics than the parts above, although richer than in the region of the inferior vocal cords. Again, those English laryngologists who have had most experience of malignant disease of the larynx do not agree with Cunéo's statement that glandular infection occurs early in cancer attacking the superior vocal cords; on the contrary, glandular infection is met with in such cases as a rule at a late stage, usually when the disease has spread to the extrinsic parts of the larynx.

In my opinion, the immunity of the glands to secondary infection depends mainly on the original site of origin of the malignant growth. If intrinsic, glandular infection is rare and only occurs late; if extrinsic, it is the rule, and occurs early. This difference in the tendency to implication of the neighbouring glands according to whether the disease

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is of intrinsic or extrinsic origin is due, in my opinion, to the distribution of the lymphatics already described in these two areas.

It has been amply demonstrated that the lymphatic meshwork is much less dense in the area described as intrinsic than in the extrinsic area, and it is to this diminution and attenuation of the lymphatic radicles in the intrinsic parts that the marked immunity to early glandular infection must be ascribed.

A secondary factor, as has already been pointed out, probably exists in the tendency to progressive atrophy, normally found, of the lymphatic system in the larynges of old people, and this attenuation and atrophy not only applies to the laryngeal mucous membrane, but also to the lymphatic ducts that go to the neighbouring glands.

Topography of the Glands attacked by Laryngeal Carcinoma.

Bearing in mind the anatomical description already given, one finds that theoretically the chain of glands underneath the sterno-mastoid, the pre-laryngo-tracheal, and the recurrent laryngeal group of glands should show signs of infection. Special stress has already been laid on the infection of the substerno-mastoid chain; all the glands included between the posterior belly of the digastric muscle and the clavicle may become infected in cases of malignant disease of the larynx. There is nothing especially characteristic in their mode of invasion. Infected

and broken-down glands are frequently found adherent to the vasculo-nervous sheaths; they are usually independent of the larynx itself, although in some cases they have been found to be incorporated with that organ.

Cunéo has seen a case in which there was a direct extension of the growth formed by a much-thickened superior lymphatic duct which pierced the thyrohyoid membrane, and eventually became lost in a general glandular mass in the neck.

Infection of the pre-laryngeal glands is fairly rare. Most, however, has seen a few such cases.

Instead of occupying the border of the crico-thyroid membrane, the infected gland may be found placed over the middle of the thyroid cartilage (Maas*) or even its superior depression (Zeissl†). There seems to be no record of infection of the pre-tracheal glands. Jurasz and Fraenkel have seen the glands of the recurrent chain involved by cancer. Bergeat,‡ Maurer,§ and Most have also recorded similar cases; but in all the verification has been post-mortem, as enlargement of these glands, owing to their small size and depth, cannot be recognised clinically.

It was also at a post-mortem examination that Zeissl found a case of involvement of the retro-œsophageal glands. The order in which these different groups of glands become infected varies according to the initial seat of origin of the laryngeal

* Maas, *Arch. f. Klin. Chir.*, Bd. xix.

† Zeissl, *Wiener Med. Presse*, 1881, No. 44.

‡ Bergeat, *Monatschr. f. Ohrenheilk.*, 1895, p. 368.

§ Maurer, *Berlin Klin. Wochens.*, 1882, Nos. 26, 27.

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growth. When the disease is of extrinsic origin, glandular infection is most likely to occur in the upper glands of the sterno-mastoid chain. When intrinsic and above the glottis, the gland, which is first found to be enlarged (according to Schwartz), is placed at the level of the anterior border of the sterno-mastoid muscle, about the height of the space which separates the hyoid bone from the thyroid cartilage; if subglottic in origin, the lowermost glands of the same chain are generally the first to be attacked.

Bearing in mind, however, the many ways in which the lymphatic vessels draining the area in question may terminate, these rules obviously have many exceptions.

Infection of the pre-laryngo-tracheal and recurrent chains implies disease attacking the subglottic region. Inversely, in cases of growths strictly limited to the extrinsic area and regions of the true and false vocal cords, these glands remain free.

In one case of extrinsic carcinoma Cunéo was able to prove microscopically the absolute immunity of the pre-laryngeal glands, although the glands appertaining to the extrinsic area were so infected by carcinoma as to form a mass as large as one's fist. So long as one-half of the larynx only is affected, the glands only on that side are infected.

Most and Roubaud were unable to find a record of any case in which a unilateral laryngeal carcinoma had caused involvement of the glands on both sides. This agrees with the results of experimental research and of the pathological anatomy of the parts; for it

has already been pointed out that an injection of the lymphatics of one-half of the larynx, although occasionally able to cross the median line, never penetrates the lymphatic radicles of the opposite side.

Dissemination.

There is no matter of doubt that dissemination in malignant disease of the larynx is extremely rare. Out of eighteen or nineteen post-mortems for carcinoma of the larynx mentioned in Butlin's monograph, dissemination of the disease was recorded only in three instances. One of these was reported by Sands,* another by Desnos,† the third by Schiffers.‡

In the first case, that of a woman aged thirty, the tumour was confined to the left vocal cord. The symptoms commenced in September, 1862. Laryngotomy was performed in January, 1865—more than two years and a quarter, therefore, after the commencement of the disease. There was no affection of the glands of the neck, but the lumbar glands were enlarged, and the left suprarenal capsule, the left kidney, and ureter were extensively diseased.

In the second case, that of a man whose age is not recorded, the tumour arose in the left aryepiglottic fold, and extended down to the ventricular band. There was a large glandular tumour at the base of the neck occupying the sheath of the sterno-mastoid

* *New York Medical Journal*, 1865, p. 110.

† *Bull. Soc. Anat.*, 4th series, vol. iii., p. 398, 1878.

‡ *Rév. Mens. de Laryngologie*, 1883, p. 1.

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muscle, and one small mass of carcinoma was embedded in the middle of the right lobe of the liver. It is difficult to calculate the exact duration of the disease from the report, but it had probably existed for more than one and for less than two years.

The third patient was a man fifty-three years old, who was first attacked with hoarseness during March, 1881, and who died a few days before Christmas. The entire left half of the larynx was diseased, but the tumour was thought to have taken its origin in the false vocal cord. The glands along the course of the jugular vein were extensively affected, and the lungs contained many secondary nodules, varying in size from a pin's head to a nut. No operation had been performed.

It is well worthy of note that the tumour in all these cases was a well-marked specimen of squamous-celled carcinoma (epithelioma).

Other cases have been recorded—for instance, Isambert has recorded a case of epithelioma of the larynx, with carcinoma of the prepuce. Cadier, a case of epithelioma of the interarytenoid space in a patient who had been operated on three years previously for carcinoma of the breast. Thiersch has recorded a case similar to Schiffers. Schmidt has seen a case of cancer of the larynx after carcinoma of the breast. Poucet, a case of carcinoma of the frontal bone in a patient with carcinoma of the right aryepiglottic fold. Méricamp, a case of carcinoma of the left aryepiglottic fold and cricoid, contemporaneous with carcinoma of the liver. Latil, a case of cancer of the liver together with cancer of the false vocal cord.

Bronner also has recorded a case of cancer of the epiglottis with metastasis in the liver and lungs, and Grayson a case of cancer of the larynx with epithelioma of the lip. Kocher, a man, fifty-nine years of age, who died two years after partial resection of the larynx. There was no local recurrence, but carcinoma of the abdominal cavity was found post-mortem.

Pinner-Schmidt mentions a case of a woman, forty-seven years of age, in whom partial laryngectomy was performed for cancer of the larynx. The patient died seven years later of cancer of the stomach. It is a question whether in this patient the cancer of the stomach was a fresh outbreak of the disease or a secondary growth of slow progress.

Schmiegelow, again, removed half the larynx in a female aged forty-six, who was suffering from carcinoma. She died ten months later of carcinoma of the stomach. There was no local recurrence.

Morian performed a similar operation on a male aged forty-seven, who died seven weeks later. Secondary growths were found in the lungs. There was no local recurrence.

Wolff performed total laryngectomy in a male aged forty-one. The patient died two and a half years later with secondary growths in the bones and lungs.

Both Schrötter and Fauvel, men of wide experience in laryngology, have not seen a single case of metastasis, and Morell Mackenzie only once came across such a condition in his practice.

It is surely a remarkable circumstance that dis-

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semination should occur so rarely of a disease which in many instances produces death slowly, and has, therefore, ample time to become generalized. And it is still more remarkable that in the few cases in which dissemination is actually known to have occurred the abdominal viscera rather than the lungs were affected (abdominal viscera, 8 cases; lungs, 4 cases; both regions, 1 case).

It has elsewhere been pointed out* that carcinoma of the œsophagus apparently only affects the lungs under what may be termed very favourable conditions—when, for example, fragments of a tumour which has penetrated into the air-passages are carried into the terminal or almost terminal bronchial tubes. Here, however, is a disease situated generally immediately over or within the entrance to the air-passages, therefore, as one might suppose, constantly furnishing fragments which are carried into the lungs with the inspired air, yet scarcely under any conditions obtaining a hold upon them. The rule is the same not only for the squamous-celled carcinomas, which we are, most of us, inclined to regard as little liable to dissemination, but also for the spheroidal-celled carcinomas, which in the larynx, as in other parts, are sometimes very soft and cellular, and therefore of the kind most given to dissemination.

There are, of course, some conditions which may possibly be regarded as modifying the conclusions which have been drawn from post-mortem examinations. In the first place, death has resulted directly from operation in many cases, and although the

* Butlin, 'Sarcoma and Carcinoma.'

disease in many of these lasted for a long time, it may fairly be said that its natural course was cut short.

In the second place, although the disease was situated over the entrance to the air-passages, and fragments were liable to be sucked in during inspiration, tracheotomy was performed in several instances, and this danger, therefore, to a certain extent was averted. In many cases, however, in which an autopsy was made no operation had been performed; and even in those cases in which the trachea had been opened there was nothing to prevent dissemination through the circulation, by far the most frequent medium for the dissemination of malignant disease generally. It is certainly most difficult to understand why a malignant disease situated in so important an organ should be so little given to dissemination. It is the more difficult to understand because experience shows that carcinoma of the larynx is in other respects a very malignant disease, and has been until quite recent times very little amenable to radical treatment.

Histological Structure.

All authorities agree that epithelioma is the variety of cancer that attacks the larynx the most frequently. Encephaloid (carcinoma medullare), scirrhus, and cylindrical-celled carcinomas have all been met with in the larynx, but are, especially the last two varieties, exceedingly rare.

Schwartz, out of 103 cases of laryngeal cancer,

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found 54 to be epithelioma ; Schrötter, out of 20 cases, 17 ; Ziemssen, out of 68 cases, 57. Sendziak notes 248 cases in his statistics, and Semon, out of 103 cases, 40 epitheliomas.

Cylindrical or columnar-celled carcinoma appears to be exceedingly rare. Only a few cases are to be found in the literature of the subject. It is somewhat surprising that columnar-celled carcinoma is not more common in the larynx, for the origin of the disease is by no means limited to those tracts of the mucous membrane which are covered with squamous epithelium.

Apparently the influence which suffices during health to maintain the normal relation between the two varieties of epithelium, confining each variety to its particular areas, and suffering neither to intrude upon the other, disappears under pressure of disease, and the squamous epithelium, being, as it were, the stronger and more enduring variety, impresses its form upon the elements of the cancer, which thus becomes a squamous-celled carcinoma.

SYMPTOMS.

The symptoms of carcinoma of the larynx, especially in the early stages, depend to a certain extent, as might be expected, on the situation of the growth. There is no one symptom that is absolutely diagnostic of the disease.

The *intrinsic* growths usually commence with *hoarseness* and occasionally slight cough, symptoms

which indicate a laryngeal catarrh rather than a more serious affection.

Considerable importance, however, attaches to this hoarseness. It is frequently the only symptom of early malignant disease involving the true vocal cords or anterior commissure, and may last as long as a year without any other evidence of malignant disease presenting itself.

A most careful laryngoscopic examination should always be made in any middle-aged patient who complains of obstinate hoarseness of any appreciable duration, even if there be no other symptom of any kind.

As the disease advances and ulceration supervenes, the hoarseness increases, and the voice may eventually be entirely lost. The *extrinsic* growths, especially those of the epiglottis and arytenoids, more often produce dysphagia than hoarseness, and it is not until the disease is far advanced and the intrinsic muscles or cartilages are involved that vocal and respiratory troubles are observed.

Involvement of the neighbouring glands and pressure on the recurrent laryngeal nerves, or displacement of the arytenoid cartilages, will, when present, affect the voice in extrinsic carcinoma. When the cricoid plate is primarily affected, early and extensive involvement of the neighbouring glands is the rule.

Difficulty and pain in swallowing, the secretion of frothy and blood-stained mucus, are also early symptoms of carcinoma of the cricoid plate. Involvement of the glands under the angle of the jaw, and

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subsequently along the whole length of the sternomastoid, soon follows, and as the growth increases in size, not only does the dysphagia increase, but dyspnœa becomes marked and urgent. The dyspnœa is due to involvement of the muscular substance of the posterior crico-arytenoid muscles and their subsequent myopathic paralysis, with gradual narrowing of the glottis (Semon).

Again, *pain* is a symptom which belongs especially to extrinsic tumours, although it is by no means unknown in cases of intrinsic tumour. The pain is sometimes peculiarly severe, and is not limited to the larynx or even to the parts around, but radiates over the whole of the neck on the affected side and is frequently complained of in the ear, resembling in these respects the referred pain in cases of toothache and of hip disease.

In some of the cases of intrinsic carcinoma no pain is experienced during the whole course of the disease; in other cases, although the pain is not spontaneous, it is produced by swallowing or speaking.

The radiating pains to the ear are, however, very characteristic of malignant disease, and are not so frequently noted in other affections of the larynx. They are probably due to irritation of the fibres of the superior laryngeal nerve by the growth; this irritation is referred to the auricular branch of the pneumogastric nerve, and thus pain is felt in the ear. In a few cases local tenderness on pressure has been present.

Expectoration is in some cases very abundant, but it is rarely so unless the growth is deeply ulcerated

or extensive. The sputa are at first usually frothy, but later become purulent, and may be stained or streaked with blood; there may be considerable fœtor of a sickly, musty odour and cough, especially in the later stages, from breaking down of the malignant masses. Sometimes a fragment of the growth or even of the cartilages of the larynx is coughed up.

Hæmorrhage is an unusual symptom, and scarcely ever occurs unless the disease has extended to the tongue or neighbouring vessels, but few fatal cases are recorded as actually resulting from hæmorrhage. In one the base of the tongue was extensively affected, and in four or five others repeated bleedings hastened, although they did not actually produce, the fatal result (Türck, Dreyfuss, Desnos, Maydl).

Dyspnœa.—Occasional attacks of dyspnœa show that the gravity of the disease has been underrated. It usually at first shows itself on exertion, and is generally due to direct obstruction by the tumour, although infiltration and consequent weakness of the intrinsic laryngeal muscles plays an important part. Later on in the progress of the disease there may be very severe paroxysms of dyspnœa due to glandular pressure on, or involvement of, the laryngeal nerve or trachea, in other cases to œdema or stenosis of the glottic aperture.

Dysphagia has already been referred to as an early symptom when the site of the disease is the epiglottis or arytenoid region. It is uncommon in cases of carcinoma of the true or false vocal cords. Scheier in 102 cases noted its presence in only 15

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cases, and in each of these there was ulceration present.

In a few rare cases the symptoms are from the very first those of perichondritis (pain, fever, dysphagia, and alteration of the voice), and in such cases errors of diagnosis are likely, the disease tending to be mistaken for tubercle or syphilis of the larynx.

Cachexia is far less common than in carcinoma attacking other parts of the body; it is especially infrequent in intrinsic carcinoma. When the growth is of extrinsic origin and the neighbouring glands have become involved cachexia may supervene, but even in these cases it does not become marked until the disease has reached a very advanced stage.

This comparative immunity to cachexia is in accordance with the rarity of dissemination of the disease, and is probably attributable to the lymphatic isolation of the larynx already referred to under Pathology.

SIGNS.

The appearance of the disease as seen by the laryngoscope varies somewhat according to its situation.

Carcinoma of the epiglottis sometimes appears as a destructive ulceration, but more frequently it presents itself as a distinct and nodular tumour of a grayish or pinkish white colour, which may be limited to the epiglottis, or may extend to the base of the tongue, the lateral walls of the pharynx, œsophagus, or to the aryepiglottic folds. The

affected part is from an early stage seen to be fixed, and if the finger be inserted into the mouth the epiglottis will be felt to be hard to the touch. The primary tumours of the arytenoids and the ary-epiglottic folds are generally masses of considerable size, and present the same outward characters, whether they are squamous-celled or sphenoidal-celled carcinomas.

If ulceration is present, the ulcer is characterized by its irregular crateriform shape, its heaped-up everted edges, its foul sanious discharge, and by the very early immobility of the part affected. Fungating granulations of a reddish colour sprout up, and may be seen one day and be found to have almost disappeared the next. When the perichondrium becomes involved considerable œdema may be present surrounding, and possibly obscuring, the original growth.

If the disease presents as a distinct mass or masses, it may at first resemble simple papillomata. The tumour, however, in malignant disease has a broader base, is of firmer consistency, and tends early to deep infiltration of the neighbouring parts.

Malignant disease of the ventricular bands may appear as a unilateral tumefaction, as a general infiltration pinkish or reddish in colour, with a coarsely mammillated uneven surface, or may present itself as a definite tumour, sessile, solitary, dusky-red in colour, sometimes smooth, but more often irregular in shape, and frequently closely resembling a wart in appearance.

On the *vocal cords* carcinoma in the early stages

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may present itself as (*a*) a unilateral congestion or swelling, the unilateral character of the swelling being always suggestive of commencing malignancy; (*b*) as an infiltrating growth of a reddish and uneven surface, and no tendency to limitation; (*c*) as a single reddish or pinkish sessile growth, sometimes ulcerated, and very like a papilloma, more rarely a fibroma, in character.

If the growth be pedunculated, the similarity to a papilloma or fibroma becomes more marked. In a case observed by Semon the papillomatous appearance of a small epithelioma was masked by a large blood-clot which had formed round the papillomatous excrescences, the new growth being taken by several observers for an angioma.

A zone of circumscribed hyperæmia surrounding a malignant new growth is not by any means infrequent, and is particularly noticeable when the growth occupies the mid region of the vocal cord, the anterior and posterior parts of the cord standing out a brilliant white, in marked contrast to the hyperæmic area.

Here, again, in growths or infiltrations attacking the true vocal cords, and of a malignant nature, impairment of mobility of the vocal cord becomes a sign of the greatest importance, and is again referred to more fully under Differential Diagnosis. Malignant disease of the larynx is usually insidious in its onset, extending somewhat slowly, yet surely, at first. Later on it advances rapidly, growing in size and invading the neighbouring parts of the larynx. Carcinoma commencing on one of the true or false vocal

cords is somewhat liable to spread to the fellow cord on the opposite side.

Whether the disease be squamous or spheroidal-celled, it generally presents the same outward characters, so that it is rarely possible to tell from the macroscopic characters to which variety it belongs.

Ulceration is very common, almost as much so of the spheroidal-celled as of the squamous-celled carcinomas. The time within which ulceration becomes apparent is liable to considerable variation in individual cases. Sometimes it is seen within three or four months from the onset of the disease, in other cases ulceration may be delayed for a much longer period, even for so long as a year and a half from the commencement of the disease. In many cases the destruction and resulting deformity and displacement is very great, and constitutes a most striking character of the disease.

In the later stages, whether the disease be of intrinsic or extrinsic origin, the entire larynx is liable to become involved. The tumours which arise within the larynx occupy the whole of the cavity, and when involving the cartilaginous framework marked broadening and tenderness of the larynx may be seen and felt. Sometimes the growth perforates the cartilages or passes between them, invading rapidly the surrounding muscles, and finally presenting as a fungating mass through the skin.

The tumours which arise in the outer portions of the larynx pass down the sides and into the cavity, and destroy large pieces of the cartilage and mucous

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membrane. When once the disease has reached the stage in which the whole larynx is more or less involved, and transformed into a mass of broken-down ulcerating tissue, with prominent exuberant masses of granulations, and in most cases glandular involvement, there can usually be no difficulty in diagnosis. Unfortunately, in this stage but little, if anything, can be done for the patient.

It is of importance to remember that it is sometimes impossible to limit from the laryngoscopic picture the extent of the disease present. Even when the growth forms a mass as large as a nut or larger, it may be so situated that only its upper surface is visible on laryngoscopic examination.

If left to pursue its course, malignant disease of the larynx usually ends fatally within three years of its appearance. With progressive emaciation the patient becomes feebler and feebler and dies. In some cases an intercurrent affection such as bronchitis or 'foreign body' pneumonia, due to the inhalation of secretion or particles of the growth or food, ends the scene. In others a fatal termination results from sudden or repeated hæmorrhages, dyspnoea, or severe dysphagia.

DIAGNOSIS.

The diagnosis of an advanced carcinoma is in most instances very easy. The extensive ulceration, the implication of several structures, the destruction wrought by the disease, the steady progress of the symptoms, the radiating pain and pain in the ear,

and (in cases of extrinsic cancer) the enlargement of the lymphatic glands, exclude all doubt of the malignant nature of the malady. But in the earlier stages the diagnosis is often beset with difficulties, and may be impossible.

The principal points to lay especial stress on in early malignant disease of the larynx are the age and sex of the patient, the symptoms, especially that of hoarseness without obvious cause, and the presence or absence of any constitutional diathesis, the laryngoscopic appearances, and whenever possible the removal and examination microscopically of a fragment or fragments of the growth by a skilled pathologist.

If too small or too superficially extirpated fragments be examined, mistakes may be made. When a fragment has been removed for microscopic examination, several sections should be cut and carefully examined. If no evidence of malignancy be found, it is advisable, if the clinical symptoms justify it, to remove a further and deeper part of the growth and subject it to a similar careful examination.

Cases are on record of tumours partaking of a mixed character—*i.e.*, papilloma and carcinoma (Semon) being present in the larynx.

It is important to bear in mind that a negative verdict by the pathologist is not sufficient to set aside clinical appearances when they are markedly suggestive of a malignant type. It devolves on the surgeon in such cases to have the courage of his own opinion, and to be prepared to form a definite diagnosis from clinical signs alone.

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A differential diagnosis has to be made from inflammatory diseases, benign laryngeal tumours, pachydermia laryngis, syphilis, tubercle, lupus, laryngeal paralyses and perichondritis. From *chronic laryngitis* malignant disease, if associated with marked hyperæmia, can usually be diagnosed by its unilateral character, the contrast if a vocal cord be affected with the normally white one being very marked.

At the same time it is well to remember that cases have occurred, although rarely, in which apparently simple bilateral congestion of the vocal cords has preceded malignant disease; the possibility, therefore, of malignancy should be borne in mind if an apparently simple chronic laryngitis, even though bilateral, does not yield to its usual remedies (Semon).

As time goes on a most important sign becomes noticeable—namely, sluggishness of movement of the affected vocal cord, ‘impaired mobility.’ This impaired mobility is often present at a very early stage of the disease, but naturally varies according to the situation of the disease. For instance, in cases where the origin of the growth is the ventricle of Morgagni, the cord on the affected side may be entirely covered by the mass, but yet be quite free in its movements.

This sign, to which Semon was the first to draw attention, is of great diagnostic importance, and has been but little understood and valued on the Continent. In England its value has been fully appreciated, and has certainly helped enormously in correct diagnosis of early malignant disease of the vocal cords. Of this sign Semon (*‘Encyclopædia Medica’*)

says: 'The value of this sign, to which I was the first to draw attention, has been repeatedly decried, and my utterances on this subject have been curiously misunderstood by some Continental authors. I wish, therefore, to declare as plainly as possible that I neither believe such impairment of mobility to be present in *every* case of early malignant disease of the vocal cords, nor that its *absence* in any way militates *against* the disease being malignant. All I contend is that if in the case of a doubtful growth springing from a vocal cord—and not only when the growth is situated near the crico-arytenoid articulation, but even in the anterior part of the vocal cord—an impairment of mobility—*i.e.*, some sluggishness of the movements of the affected cord—is observed, this is a most valuable sign, pointing to the malignant nature of the affection.'

From *benign laryngeal tumours* (papilloma, fibroma, cysts), the presence or absence of infiltration, the age of the patient, and the plurality of the growths are among the most important points to determine. It is also of great importance to note the site of the growth. A malignant neoplasm may grow from any part of the vocal cord, but most frequently arises from the middle or posterior third of the vocal cord; when a growth is seen to originate in these situations in a patient over fifty years of age it is always to be looked upon as suspicious, and is not the usual seat of origin of benign papilloma.

It is especially the differential diagnosis between papillomata and malignant disease that is often so difficult. Besides the points already referred to, the

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mobility and more circumscribed appearance of the papilloma, together with its consistency, the younger age of the patient, the length of time the disease has existed, and the free mobility of the vocal cord or cords are the main signs to be guided by.

Usually, too, the papillæ in the benign growth are much longer and coarser than in a warty carcinoma, their tips are rounded instead of pointed, and if the colour of the tumour be snowy white instead of a pinkish colour, as is usual in laryngeal papilloma, there is still further corroborative evidence of the malignant nature of the growth.

In fibroma the tumour is generally of globular shape, does not tend to ulcerate, and when growing from a vocal cord, however large it may tend to become, never causes any impairment of mobility of the cord; whereas in malignant disease, even if the growth be semiglobular in form to begin with, it tends to become mammillated, to ulcerate, and to cause impairment of mobility of the affected vocal cord. If after removal of an apparently innocent growth rapid recurrence takes place or a dirty, sloughy ulcer is left, malignant disease is to be suspected, especially if the patient be beyond middle age.

From *Pachydermia laryngis* (*Pachydermia verucosa* of Virchow) the diagnosis is made by the typical appearance presented by the latter disease—namely, in the early stages symmetrically-placed wart-like growths occupying the posterior third of the vocal cords or interarytenoid space, and in the later stages the crateriform depression at the top of one tume-

faction with a corresponding elevation on the other. Moreover, the *cords remain freely movable*, there is very much less hoarseness than in malignant disease, and there is usually a well-marked history of chronic alcoholism. From *syphilis* of the larynx, especially when the latter presents itself in an ulcerative form, the diagnosis is often replete with difficulties, and particularly so, as cases of the two diseases being present together have been recorded (Hunter, Mackenzie).

There is generally a marked absence of pain in syphilitic ulcerations of the larynx, and the ulcers that form as a result of the breaking down of gummata are usually sharply cut out and depressed, and extend rapidly, at first, from the centre to the periphery. Their base generally shows a more or less typical wet chamois-leather-like slough. If the syphilitic ulcer be solitary, it rarely becomes as large in size as a carcinomatous one. Later on cicatrization with, possibly, extensive deformity and stenosis results.

In other cases a diffuse infiltration attacks the epiglottis, vocal cords, or interarytenoid fold. The extent of the infiltration and the absence of any distinct growth are usually sufficient to prevent a diagnosis of malignant disease being made.

Other manifestations of syphilis may be present. At any rate, in cases of doubt, even when syphilis is not suspected, it is a good rule to administer iodide of potassium 10 grains internally, and to gradually increase the dose to 30 grains three times a day. Careful note should be made of any changes in the

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size or extent of the ulcers or infiltration, for it should be remembered that an apparent improvement may follow on the administration of iodide of potassium in malignant disease, due not to any effect on the growth itself, but to resorption of the surrounding inflammatory œdema. This improvement is, of course, only temporary.

From *tubercle*, as a rule, the diagnosis is easy, yet there are many cases in which it is extremely difficult to give a definite opinion. Patients suffering from tuberculosis of the larynx are usually of a younger age than those attacked by malignant disease. The affection is generally bilateral—in malignant disease, at any rate—in its earlier stages unilateral. There is more or less actual tumour formation in tuberculosis, and the ulcers that form are generally multiple, superficial, and of a 'mouse-nibbled' appearance at the edges. Œdema and pallor of the surrounding parts, especially of the epiglottis and arytenoids, are usually well marked, and the condition of the lungs and sputa on examination will generally give corroborative evidence. Cases have, although rarely, been published in which carcinoma of the throat has co-existed with general phthisis (Wolfenden).

From *lupus*, the youth of the patient, the very slow progress of the disease, the resulting cicatrization and deformity, the absence of pain, and the presence of the same disease in other parts, as the pharynx or skin, render the differential diagnosis sufficiently easy. From various forms of *paralysis* difficulties in differential diagnosis are not likely to occur.

Semon, however, has seen two cases in which the

appearances were absolutely those of bilateral abductor paralysis, the vocal cords lying close to one another in the mid-line of the larynx. The subsequent history proved that this appearance was due to subglottic malignant disease, in one case to an epithelioma, in another to sarcoma.

PROGNOSIS.

There can be no manner of doubt that the prognosis of any given case of carcinoma of the larynx varies very greatly according to (a) the original site of the growth; (b) the period at which the disease comes under observation; (c) the general health of the patient.

There is nothing more remarkable in the recent operative work on cancer generally than the results obtained by radical operation in certain cases of cancer of the larynx. If the disease be of intrinsic origin, limited in extent—that is to say, seen and diagnosed in an early stage—the patient not too old, and in fairly good general health, and willing to undergo immediate operation, the very best results may be anticipated with safety. At any rate, in England such cases operated on almost entirely, be it said, by thyrotomy, have resulted within recent years in lasting cures exceeding 80 per cent. Such results speak for themselves.

By contrast, however, the prognosis becomes increasingly grave in cases where the disease, although of intrinsic origin, has become very exten-

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sive ; when the lymphatic glands have become involved, the patient is old and his general health bad.

The prognosis is always grave in cases of extrinsic origin by virtue of the early lymphatic involvement, and especially so in carcinoma affecting the cricoid plate. Nevertheless, it must be remembered that recent improved methods of operation have even in these bad cases given some exceptionally good results, notably at the hands of Gluck, of Berlin, although the patients are of necessity subjected to loss of the whole larynx, and a consequent very pitiable after-condition.

TREATMENT.

The treatment of carcinoma of the larynx may best be discussed under two headings :

1. Radical treatment by operation.
2. Palliative treatment.

Radical Treatment.

Methods of Operation—(I) Endolaryngeal Removal.—Although removal of the disease, whether sarcoma or carcinoma, *per vias naturales* has in a few instances been attended with brilliant results, this method should only exceptionally be resorted to. It is undoubtedly founded on wrong surgical principles. As in malignant disease elsewhere, malignant disease is from the beginning of an infiltrating nature, and for its extirpation it is essential that a sufficiently

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wide area of the surrounding healthy tissues be removed with the growth. This can but rarely and with no degree whatever of certainty be accomplished by endolaryngeal operations. Moreover, it is a well-known fact that the infiltration in malignant disease is nearly always of much greater extent than would have been thought from the laryngoscopic examination.

The class of cases in which it may be employed are those in which the disease is found to be very limited and quite on the edge of the vocal cord, and in which extreme old age or very serious impairment of the health preclude an external operation, or in which the patient refuses any external operation.

The uncertainty of the method, the probability that the disease will not be sufficiently removed, and the possibility of irritating a very indolent disease and exciting it to rapid and dangerous growth, must all be taken into account in concluding to attempt the removal of malignant disease of the larynx through the mouth.

(2) **Suprathyroid Laryngotomy** (subhyoid pharyngotomy).—This operation has been performed occasionally in cases where the malignant growth has been situated at the upper opening of the larynx, particularly in connection with the epiglottis. Butlin, however, is strongly of opinion that all growths occupying the sides and back of the larynx can be more thoroughly exposed and removed by division of the thyroid cartilage (laryngo-fissure—thyrotomy) than by suprathyroid laryngotomy, and that the epiglottis can be better dealt with by thyrotomy.

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The operation of suprathyroid laryngotomy is carried out by making a transverse incision through the thyro-hyoid membrane along the lower border of the hyoid bone; the incision divides the skin, superficial fascia, inner half of the sterno-hyoid and thyro-hyoid muscles, the membrane itself, and the mucous membrane between the base of the tongue and the epiglottis.

The epiglottis is now seized and brought out through the wound, and the growth removed in such a manner as appears most suitable to the individual case. The length of the incision and the structures which are divided vary according to the size and situation of the tumour.

There is little if any hæmorrhage, the vessels wounded being few in number and insignificant in size. After the operation the wound is carefully closed with fine silk sutures, and healing should take place by first intention.

(3) **Infrathyroid Laryngotomy.**—This operation has been advocated and practised for the removal of growths on the under aspect of the cords, or actually below the cords (subglottic growths). Thyrotomy, however, with a downward extension of the incision gives more room and a better chance of thorough removal of the disease, and is therefore to be preferred.

By this means Butlin has removed tumours an inch below the vocal cords, and for those which lie immediately below the cords there is no necessity to practise even a modification of the ordinary operation of thyrotomy.

Infrathyroid laryngotomy is performed in just the same way as laryngotomy, but the incision is made transversely, and not vertically, as in laryngotomy. The only vessel likely to give rise to any hæmorrhage is the crico-thyroid artery, and, if cut, its ends should be secured before incising the crico-thyroid membrane.

(4) **Thyrotomy** or **Laryngo-fissure** has, during the last fifteen years, been performed much more frequently than any other operation for the removal of malignant disease of the larynx in this country, and has steadily gained in repute during that period. It is particularly applicable to sarcomas and carcinomas of intrinsic origin. As Butlin (in conjunction with Semon) has been mainly responsible for the introduction of it into this country in cases of malignant disease, and for such modifications in the after-treatment as have served to render it far less fatal than it used to be, a description of Butlin's method of performing the operation is herewith given.

The patient, having been placed in a good light, chloroform or A.C.E. mixture is administered; ether, if possible, should be avoided, as it excites the secretion of much mucus and saliva, which obscure the parts to be removed. The patient being anæsthetized, the shoulders and neck are raised and the head is thrown back. The skin is prepared as for any other operation. An incision is made from the hyoid bone accurately in the middle line down almost to the sternum, and the structures are divided right down to the thyroid cartilage and the trachea,

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including generally the isthmus of the thyroid gland. The vessels, mostly veins, are clamped. The trachea is then freely opened below the cricoid cartilage, and a Hahn's compressed sponge cannula inserted.* It is of the greatest importance that the compressed sponge be rendered thoroughly aseptic before it is used.

Thus ends the first part of the operation, for an interval of ten to twelve minutes must now be allowed before the larynx is opened, in order to permit of the expansion of the compressed sponge, the object of which is to occlude the lower air-passages and prevent the entry of any blood or other liquids therein when the larynx is opened. There should be no undue haste to open the larynx after tracheotomy has been performed, the full ten minutes' interval being carefully observed. During this interval the clamped vessels should be ligatured, and the

* There is a tendency at the present time to dispense with the tampon cannulæ, Kocher lately having renounced them altogether. If, however, as is still usual, a tampon cannula be used, that of Hahn is to be preferred. Butlin gives the following reasons for his preference of this tube: (1) It consists of an inner and outer tube, the former of which is the longer, and projects about $\frac{1}{4}$ inch in front of the shield, thus rendering the entrance of blood less likely. (2) The outer tube is partly covered with a layer of compressed sponge previously soaked in iodoform and ether (1 in 7). (3) About ten minutes after the introduction of the tube the sponge swells up from absorption of moisture and effectually tampons the trachea, thus preventing the entrance of liquids. This arrangement of sponge holds the tube steadier than the indiarubber bag of Trendelenburg's cannula, which latter, moreover, is liable to become slippery, to leak, or even burst, during the progress of the operation.

upper part of the wound be kept covered with gauze.

At the expiration of the ten or twelve minutes the thyroid cartilage, which has been exposed by the preliminary median incision, is split in the middle line from below upwards. This is important; for, as the cartilage is generally calcified and requires the use of bone forceps, the inner blade of the forceps working from above downwards may slit or detach one of the vocal cords at its anterior extremity. If the growth proves after all to be innocent, and does not call for removal of any part of the vocal cords, such an accident results almost certainly in permanent injury to the voice. In patients of such an age as those in whom these operations are performed it is not unusual to find the thyroid cartilage ossified, and this condition may necessitate the use of a saw for its division.* The crico-thyroid membrane is divided down to the cricoid cartilage, and the incision is carried upwards beyond the level of the upper border of the thyroid cartilage in order to gain as much space as possible, but it is desirable not to interfere with the attachment of the epiglottis,

* Quite recently Mr. Waggett, of London, has invented a pair of shears for division of the thyroid cartilage without damage to the vocal cords. The shears have strong thick blades set at a right angle to the handles. The inner blade is inserted below through an incision in the crico-thyroid membrane. The outer blade is provided with a projecting tooth at its distal end. This tooth enables the surgeon to fix the blade exactly in the mid-line of the larynx before cutting through the thyroid cartilage. The instrument has been used in several cases of thyrotomy, and found to be very efficient.

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unless the situation of the growth makes this imperative.

The two alæ of the thyroid cartilage are then held widely apart by means of silk threads passed through each. The interior of the larynx is sponged out dry, and is then brushed with a 20 per cent. solution of cocaine, the effect of which is to cause contraction of the small vessels and lessening of any hæmorrhage, and also a diminution of the sensibility of the parts—a very important point if the patient is not deeply under the influence of the anæsthetic used.

At this stage of the operation the use of a frontal mirror and a good source of light in order to illuminate the interior of the larynx and define the extent and exact situation of the disease will be found of great advantage.

Two elliptical incisions carried down to the perichondrium and surrounding the diseased tissues, and including more than half an inch of the surrounding apparently healthy tissues, without respect to the after-use of the voice or any other consideration except the complete removal of the disease, are made with knife or scissors. The included area is cut out right down to the cartilage, which is laid bare, and finally scraped absolutely bare with a Volkmann's sharp spoon. The cavity left is plugged with iodoform gauze, upon which pressure is made for two or three minutes. By this means the bleeding, which is never serious, is checked. The gauze is then removed and the surface dusted with powdered iodoform.

Neither Butlin nor Semon has used the galvano-

cautery to the interior of the larynx for some years past, and neither has ever seen bleeding which could occasion the least anxiety. If a small vessel spouts it should be ligatured with the finest catgut or silk.

The alæ of the thyroid cartilage are now brought together with a couple of silk or silver sutures, and are brought into as close apposition as possible. The Hahn's tube is removed, and the edges of the wound in the soft parts brought together and sutured, except at the lower part where the tube was inserted. It is infinitely safer to leave this part open, so that there may be a ready exit for the escape of blood and other liquids from the larynx and trachea, and in order to guard against cellular infiltration beneath the skin.

In order to hasten convalescence, some* operators have lately closed the entire wound. It is, however, a proceeding to be condemned, as it aims solely at shortening what is really a very short after-treatment, and does so with decided risk to the patient.

Butlin has devoted considerable attention to the after-treatment of these operations, which is now conducted on the following lines: Hahn's tube is

* Moure (*Journal of Laryngology*, December, 1903), after thyrotomy, sutures completely the laryngo-tracheal opening from top to bottom—that is to say, he omits all kinds of cannula. For prudence' sake he leaves unsutured a spot corresponding to the tracheal opening, but brings the lips of the tracheal aperture together. An assistant has to remain close at hand for twenty-four to forty-eight hours in case the cannula has to be suddenly inserted. Moure claims that this closure hastens cure and lessens materially the tendency to broncho-pneumonia. He has had no death from the operation as he practises it.

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removed as soon as the operation is finished, and no tube of any sort is employed in its place. A piece of cyanide or iodoform gauze is placed over the wound, and secured by means of a single turn of bandage. The piece of gauze is changed by the nurse as frequently as it becomes soiled. The patient is placed on his side with only a single flat pillow for the head, that side being lowermost which corresponds to the half of the larynx operated upon. In this position all liquids tend to pass out of the air-passages, especially through the external wound.

Formerly the sponge cannula was left in the trachea for the first twenty-four or forty-eight hours, in case any secondary hæmorrhage occurred, and the interior of the larynx was packed with strips of iodoform gauze. After the Hahn's tube was removed, an ordinary tracheotomy tube was inserted. There is no doubt that the compressed sponge surrounding Hahn's tube has in some cases of thyrotomy, where it has been retained from twenty-four to forty-eight hours, acted as a source of septic infection. Again, the strips of iodoform gauze packed into the larynx in the earlier operations acted as irritants to that organ, becoming soaked in mucus and saliva, and in some cases getting displaced, hanging down the trachea and acting as foreign bodies. Hahn's tube and the iodoform gauze plugging were therefore entirely discarded by Butlin, and with most excellent results.

Within four or five hours of the operation an attempt may be made to swallow. The patient is allowed to lean well over to the opposite side to that

operated on, and the dressing is taken off the wound, beneath which a basin is placed. Cold sterilized water is drunk out of a feeder placed in the corner of the mouth. If this experiment is successful, all the water passes down into the stomach; if it is only partially successful, some escapes into the larynx. The posture, however, of the patient insures that it runs out through the wound and does not enter the air-passages. If there is any fear of collapse, and the patient be feeble or very old, brandy and beef-tea may be administered by the rectum. As soon as water can be swallowed with ease, milk, beef-tea, and other liquids may be drunk, for the fear of 'deglutition pneumonia' (*Schluckpneumonie*) is practically at an end. The wound is generally closed within ten or twelve days of the operation, and the patient is rarely confined to the house for more than ten days. This description applies only to those cases in which the disease is limited to the soft parts of the larynx and is of small extent.

In other cases the operation may need to be modified, even to the extent of removal of a large part, or even the whole, of the framework of the larynx. The operation may thus pass into that of a more or less atypical partial laryngectomy, and as almost invariably the amount of disease found to be present after opening the larynx is greater than the laryngoscopic picture has shown it to be, it should be a rule before undertaking the operation of thyrotomy for malignant disease of the larynx to obtain the patient's consent to the performance of a more extensive and graver operation if it is found necessary.

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Although the operation in some cases ends in a more or less atypical partial laryngectomy, yet the removal of insignificant portions of cartilage from the interior of the larynx, together with the diseased soft parts, should not permit the operation being classified as other than thyrotomy. Again, the operator may find on examination that the patient is not likely to be benefited by an attempt to remove the disease, and may then decide to abandon the operation, contenting himself, perhaps, with introducing an ordinary tracheotomy tube for permanent wear.

Iodoform powder may be insufflated into the larynx during the first days after the operation through the mouth by means of an insufflator with a bent nozzle. Subsequently careful periodical examinations of the larynx should be made. It is not infrequent to find a mass of granulation tissue in the anterior commissure after thyrotomy* for malignant disease. To those not acquainted with this fact, this tissue is very likely to be mistaken for a recurrence of the growth. In such cases the tissue should be left alone at first, and later a piece removed by endolaryngeal operation and submitted to microscopic examination. Almost invariably this tissue is found to be innocent in nature, and after the removal of a piece it usually shrinks, and finally disappears.

* It has been recently suggested that this granulation tissue is found in the line of the sutures uniting the two halves of the thyroid cartilage, and some operators pass their sutures through only part of the substance of the cartilage, so as to obviate any irritative action of the sutures if passing through the cartilage and thus into the interior of the larynx.

(5) **Excision or Extirpation of the Larynx, Complete and Partial (Total and Hemi Laryngectomy).**—The first complete excision of the larynx was performed by Dr. Patrick H. Watson in 1866. The patient, a male, aged thirty-six, was suffering from severe syphilitic stenosis of the larynx, and survived the operation three weeks. Billroth, in the year 1873, performed the first complete extirpation of the larynx for carcinoma of that organ, death taking place seven months later from recurrence. In 1878 the same operator excised half the larynx for the same disease.

Since that date a large number of extirpations has been performed, so that Sendziak was able years ago to put together 188 cases of total removal of the larynx for malignant disease, and might have used a larger number had the reports been sufficiently complete for his purpose. But while thyrotomy has been steadily growing in favour during the last ten to fifteen years, total extirpation has been decidedly less frequently practised.

Again, thyrotomy is the operation of the English school, while extirpation is largely practised by the German School of Surgery. Between 1881 and 1888, according to Sendziak, 110 total extirpations were performed; between 1888 and 1894 only 47.

Operation of Total Laryngectomy.

Tracheotomy.—The trachea may be opened (*a*) either some time previously, (*b*) at the time of operation, (*c*) or be dispensed with altogether.

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In patients suffering from long-continued dyspnoea it is probably an advantage to perform tracheotomy at least a week before laryngectomy. The patient becomes accustomed to breathing through the artificial apparatus, and the lungs become less engorged, consequently broncho-pneumonia is less likely to ensue. Moreover, less time will be taken up by the operation, and no blood will enter the trachea from this source. A low tracheotomy is preferable to a high one, as the latter may be too near the seat of disease.

There is a decided tendency for operators at the present time to dispense with tracheotomy altogether. In Jacobson's 'Operations of Surgery,' vol. i., p. 513, the following statement of Professor Keen is given:

'In the case which is the basis of this paper (a patient aged thirty-nine. Thyrotomy, May, 1898; recurrence in September. Complete laryngectomy, October. Recovery), I did tracheotomy at the time of operation, but removed the tube at the termination of the laryngectomy, immediately closed the wound in the trachea, and obtained absolute primary union. In any future case I am strongly of opinion that it will be better to omit tracheotomy altogether. As I shall show, it is not, in my opinion, needful, and by omitting it we shall eliminate one cause of septic pneumonia.' And, again, later: 'A further improvement can be made in the technique—viz., the omission of any, even a temporary, tracheotomy. In my next case, after dissecting the soft parts from the larynx and upper trachea back to the œsophagus on both sides, I shall place the patient in

the Trendelenburg position, and deepen the narcosis to a slight extent. I shall then divide the trachea transversely, and by three sutures, one in the mid-line and one on each side, I shall quickly attach the tracheal stump to the skin. Then I shall introduce the ordinary tracheotomy tube into the open end of the trachea instead of through a tracheotomy wound, and continue the anæsthetic through the tube. In order not to embarrass the operator, the flange of the tracheotomy tube should only project at the sides, as the usual wide upper border of the flange would interfere with access to the parts at the beginning of removal of the larynx.'

The position of the patient is a debatable one. If the surgeon decides to perform the operation by cutting from above downwards, then the position of the patient will be the same as for thyrotomy; if from below upwards, Trendelenburg's position must be employed.

Removal by cutting from above downwards is the more usual procedure, and has the advantage of leaving the division of the trachea to the last, thus avoiding the risk of the escape of blood and lotions into the trachea. It also avoids the need of using a tampon cannula.

If no tracheotomy is performed, either previously or at the time of operation, the median incision being made, the trachea is first isolated and divided, and a large tube inserted.

Professor Keen strongly advocates Trendelenburg's position in this and all operations on the upper air-passages.

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The patient should be prepared in the usual way as regards the skin, and particular attention should be paid to the teeth, nose, and mouth for three days prior to operation.

A.C.E. mixture is the anæsthetic generally used, and it should, when feasible, be given for as long as possible by the mouth, and later on when the trachea is severed through the tracheotomy tube by tubing attached to the inner tube.

If the operation be begun from above downwards, a vertical incision is made from the lower border of the hyoid bone exactly in the middle line down to the level of the second or third ring of the trachea. This vertical incision is usually supplemented by a transverse incision across the thyro-hyoid membrane just below the great cornua of the hyoid bone, or across the thyroid cartilage, and passing outwards to the sterno-mastoid muscles. The vertical incision, as in thyrotomy, should go down to the thyroid and cricoid cartilages and trachea.

After securing the superior and inferior thyroid arteries, the fascia in the mid-line must be well divided, and the soft parts turned back from the cartilages and trachea with a broad periosteal elevator or rugine to a level with the middle of the junction of the larynx and pharynx.

In some cases the flaps have to be turned back even further, and the sterno-mastoid muscles partly divided. This is not necessary, however, unless the disease has extended into the surrounding structures, or the glands are to be removed at the same time.

It is better to open the larynx by carefully dividing the thyroid cartilage in the mid-line before determining the extent of the operation, although some operators object to the practice on account of the greater difficulty afterwards in removing the larynx. But it is so important to be certain of the limits of the disease before proceeding to perform extirpation that this consideration outweighs any disadvantages which arise from the splitting of the thyroid cartilage. If the disease is quite limited to the soft parts, yet of large extent, the operation may be limited to the very free removal of the affected tissues, with a wide area of the surrounding healthy structures. And this may do as much for the patient as would be accomplished by the removal of any part of the laryngeal framework. If the disease is limited to one-half of the larynx, the operation of partial excision may be carried out and the healthy side of the larynx be left. Again, in cases in which it is found to be necessary to remove the entire larynx, the operator may judge from his inspection of the disease whether the epiglottis and cricoid cartilage should also be removed.

Before proceeding to the actual removal of the larynx, the sterno-hyoid, sterno-thyroid, and thyro-hyoid muscles having been separated and turned off the thyroid cartilage, the lateral lobes of the thyroid gland must be carefully separated with a raspatory, and the soft parts at the sides which contain the large vessels carefully retracted, and the larynx alternately pulled over first to one side and then to the other so that the attachments of the constrictor

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muscles to the thyroid and cricoid cartilages may be divided. For this purpose it is important to employ curved blunt-pointed scissors and keep very close to the cartilages.

The actual removal of the larynx is now proceeded with, and can be carried out either from below upwards or from above downwards, according to the views of the operator. It is on the whole preferable to remove the larynx from above downwards. The thyro-hyoid ligaments and membrane are divided, and the extralaryngeal attachments of the epiglottis* cut through. The entire larynx is now held well forwards by means of a vulsellum forceps, and the organ is separated from its remaining connections to the pharynx and œsophagus at first laterally and then from above downwards.

Especial care should be taken to keep close to the larynx in order to avoid wounding the large vessels and nerves which lie beside it; and if the cricoid† cartilage and upper rings of the trachea are removed, the same care should be exercised to avoid opening the œsophagus.

When or as the trachea is divided, two ligatures should be passed through the divided upper end to prevent the trachea slipping down, and the upper end is firmly secured to the skin by several points of interrupted sutures.

Finally, three to four deep silver sutures are passed

* It is far safer to always remove the epiglottis; it is of no use if left, and may be the seat of a rapidly-recurring growth.

† The cricoid, if left, interferes, according to Hahn, seriously with deglutition.

beneath the uppermost ring and attach the trachea to the skin, and a further set of fine superficial sutures unite the mucous membrane of the trachea to the cut edge of the skin.

Some operators retain Hahn's tube for two or more days after the operation; others remove it earlier, and replace it with an ordinary full-sized tracheotomy tube surrounded with iodoform gauze, the gauze being changed daily and wrung out in 1 in 20 carbolic acid. The transverse incision should be brought together at the ends by one or two sutures, but the vertical incision should be left open for drainage, the wound being tamponaded with iodoform gauze.

After-treatment.—The dressings should not be changed too frequently, but at each dressing careful cleansing of the large wound must be carried out.

The patient is fed during some days through an indiarubber tube, which may either be permanently retained as long as it is requisite or may be passed for each feeding. At the end of four or five days an attempt is made to swallow. The same posture and precautions should be adopted as have been described in the operation for thyrotomy, but soft solids such as jelly are generally more easily swallowed than liquids.

The temperature of the room must be kept at from 65° to 70°, and the inspired air charged with antiseptic vapours.

The sutures connecting the trachea with the skin should be removed at as early a date as possible;

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they very soon tend to become buried, and are correspondingly difficult to find and remove.

The tracheotomy tube must be kept exceedingly clean.

Partial Extirpation of the Larynx : Hemilaryngectomy.

This operation, which consists in the removal of one-half of the larynx, is in details practically identical with complete laryngectomy. The vertical incision is the same, but the transverse incision is made only on the diseased side.

The larynx having been exposed by separating the soft parts on its outer surface with elevator or rugine, the thyroid cartilage is carefully divided in the mid-line either by cutting bone forceps or saw, and the extent of the disease ascertained. If found to be limited to one-half of the larynx, and yet too extensive for removal by thyrotomy, excision of the affected half is proceeded with.

The soft parts having been carefully raised from the affected half, the attachments to the pharynx are separated, the thyro-hyoid and crico-thyroid membranes cut as close as possible to the margin of the thyroid cartilage, and the superior cornu of the latter divided at its base with bone forceps.

The aryepiglottic fold is now divided on the affected side close to the cartilage of Wrisberg; in some cases one-half of the epiglottis is split and removed.

The cricoid cartilage is now divided in the mid-

line both in front and behind, and the divided half of the larynx detached from the first ring of the trachea and thus removed.

In partial excision of the larynx for intrinsic disease there is usually no need to remove one-half of the cricoid cartilage.

The after-treatment is the same as in total removal of the larynx, but it will be found that the patient is able to dispense with the cannula earlier, and to take food by the mouth a few days after operation.

Results of Operation.

Mortality due to the Operation.—The mortality varies enormously according to the operation which is performed, and particularly so according to whether it is performed for extrinsic or intrinsic disease of the larynx. Among the many publications which have appeared in recent times, that which probably contains the largest number of collected cases is Sendziak's (*loc. cit.*).

The material has been obtained from both private and public sources, and Sendziak has given an immense amount of labour to the analysis of it. He has not, however, quite grasped the importance of a separation of the intrinsic from the extrinsic carcinomas, and apparently has not realized that the practice of this country is founded upon the great difference in the pathology of laryngeal carcinoma according as it originates from the intrinsic or extrinsic parts of the larynx. Moreover, he has not attached sufficient weight to the marked improve-

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ments that have taken place during the last ten to fifteen years.

The conclusions at which Butlin arrived from a study of the disease, and the operations which had been performed for its removal in 1883 ('Malignant Disease of the Larynx') and in 1887, when the first edition of his book, 'The Operative Surgery of Malignant Disease,' was published, were so gloomy that there seemed to him at that time to be scarcely justification for the performance of a radical operation for carcinoma. Scarcely a single case had been cured by partial extirpation, and the operation was highly dangerous to life; while the mortality consequent on complete extirpation of the larynx was extremely large, and the successes surprisingly small. Moreover, the condition of the patient after complete extirpation of the larynx was far from enviable.

Several circumstances, however, seemed to justify further experiment. In the first place, the mortality from partial resection of the larynx had not been extremely large, and it left the patient in a sufficiently comfortable condition. In the second place, an exhaustive study of the pathology of the disease led Butlin to the conclusion that Krishaber's division of carcinoma of the larynx into those of intrinsic and those of extrinsic origin was of the greatest importance and value from a pathological point of view. On the strength of this view, he suggested that 'in the immediate future extirpation of the larynx for carcinoma should be practised only for *intrinsic* carcinoma which is still limited to the larynx.'

Sir Felix Semon accepted this suggestion, and he and Butlin have been intimately associated ever since that time in working out to a successful issue the treatment of intrinsic carcinoma of the larynx by operation. The first case which seemed to Semon suitable for operation was treated by Hahn, of Berlin; the second case by Butlin; and many cases since then by Semon, Butlin, and other English laryngologists.

The nature of the operation in the two first cases was partial resection of the larynx. But almost all the later operations have consisted, as far as Semon and Butlin are concerned, in opening the larynx and freely excising the disease together with a wide area of the surrounding and apparently healthy tissues, so much so that the operation of thyrotomy is now looked upon as the English operation for carcinoma of the larynx; and Sendziak said in 1897 that Butlin personally had performed one-fifth of all the thyrotomies for cancer which were up to that date on record in medical literature.

The reasons in favour of the limitation of the operation to thyrotomy are: the very small liability of the disease to infiltrate the cartilage of the larynx, whether it is in a state of calcification or not; the similarity of the course of the disease to cancer of the lip; and the great improvement which has been made in the early diagnosis of the disease, which is very greatly due to the work of Semon.

It is sincerely to be hoped that the results to be described will tend to further popularize an operation

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which, when applied to suitable cases, is without doubt marvellously successful.

Sendziak reported 9 deaths in 92 thyrotomies performed for cancer, 4 of which occurred from pulmonary troubles, 3 from various forms of septic infection, 1 from failure of the heart, and 1 from syncope. The greater number of these operations were naturally performed for carcinoma of intrinsic origin, but the list includes operations for extrinsic carcinoma; and as these operations are decidedly more dangerous to life than those which are performed for intrinsic carcinoma, the mortality is by no means high.

Up to the end of July, 1896, Butlin and Semon had performed 17 thyrotomies (on 16 patients) for intrinsic carcinoma with 2 deaths, 1 due to sepsis, the other to bronchitis; so that at first sight their mortality seems larger than that of Sendziak's series of cases. But since August, 1896, neither of them has lost a patient from the operation; Butlin's last fatal case being in 1889, and Semon's in 1894, from bronchitis, which was present before the operation. The number of thyrotomies Semon has performed since July, 1896, up to the present time for undoubted intrinsic carcinoma of the larynx amounts to 16; in none of these has death followed the operation.

Butlin's results are similar, so that Butlin and Semon can now lay claim to a long series of cases of thyrotomy for intrinsic carcinoma unbroken by a single fatal result. These results are not due to mere accident or good fortune, but are dependent on the

improvements which have been made, both in the manner of performing the operation and even more in the after-treatment. The immediate removal of Hahn's tube, the frequent changing of the loose dressing which covers the wound, and the care given to the proper feeding of the patient have effected a most salutary change in the prospect of recovery from the operation.

Sendziak looks upon a mortality of 10 per cent. as marvellously small, but it is quite certain that 100 thyrotomies ought to be performed at the present time for intrinsic carcinoma, with a mortality of 2 to 3, perhaps less even than this.

Of partial extirpations of the larynx for carcinoma, Sendziak has collected 110 cases, with a mortality from the operation of 29, equal, therefore, to a percentage of 26·3. This percentage is, therefore, nearly three times greater than that of the thyrotomies collected by him.

By far the greater number—*i.e.*, 22—of the patients died of some form of pulmonary complication, mostly septic, 6 of collapse or cardiac failure, and 3 of hæmorrhage. Sendziak is of opinion that this percentage proves decidedly that partial resection of the larynx is by no means a dangerous operation! Surely a mortality amounting to more than one-fourth is extremely high for such an operation.

Moreover, a careful examination of his tables, from which these deductions are drawn, points to a mortality even larger than he has stated; for there appear to be more than 32 deaths, and his own list of the causes of death makes the total 36, unless

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several of the cases are placed under more than one heading.

This is certainly a larger mortality than ought to follow removal of not more than one-half of the larynx. Indeed, the far smaller mortality in the last 60 cases (performed during or since 1888) than in the first 50 strongly bears out this more favourable view. The mortality percentage is almost twice as large for the first 50 cases. This is only what might be expected from the improved methods which have been employed, not only in carrying out the operation itself, but in the after-treatment of the patient.

Total extirpation of the larynx is an extremely dangerous operation. Sendziak notes 84 deaths in 188 cases, and places the mortality at 44·7 per cent. Naturally, many of the operations were far more extensive than the mere removal of the larynx, necessitating far-reaching dissections into the neighbouring parts and removal of such parts as the muscles, lymphatic glands, and pharynx. But as laryngectomies in the future are not likely to be less extensive, it is matter of doubt whether any allowance should be made on this account.

But here, again, the later mortality is much less than that which followed the earlier operations. For instance, 56 of the 184 operations were performed during, or subsequent to, 1888, with only 18 deaths. Had the mortality been equal for the whole series there should have been 25 deaths, so that the relative mortality is very much lessened.

Schmiegelow (*Ann. des M. de l'Oreille, du Larynx*, April, 1897), mentions 50 cases of total laryngectomy

for carcinoma performed between 1890 and 1897; the mortality was 22 per cent., half, therefore, that given in Sendziak's tables.

Still later Gluck, at the meeting of the British Medical Association held at Swansea, 1903, has given an account of his operations and their remarkable and brilliant results. He performed 22 total extirpations with only 1 death, and 27 transverse extirpations of the larynx, pharynx, and glands, with also only 1 death.

Despite, however, every care and skill on the part of the operator, it is probable that the operation of complete laryngectomy will always be attended by a somewhat high rate of mortality. There must always be grave danger from pulmonary complications, nearly 40 of the patients in Sendziak's tables succumbing to pneumonia, usually of septic origin. Moreover, no fewer than 17 of the deaths were due to collapse and paralysis of the heart, a complication possibly dependent on division of the inhibitory nerves of the heart or to persistent irritation of the superior laryngeal nerve.

Cures due to Operation.—In this matter particular attention must be drawn to the different conclusions which are to be derived from a study of Sendziak's tables, and from a study of the thyrotomies which have been performed during the last fifteen years in this country. Sendziak states that 8 out of the total number of 85 were alive and well for more than three years subsequent to the operation of thyrotomy. Eight, however, of the 85 were lost sight of soon after operation, and must be left out of

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account, leaving the total at 77 cases with 8 cures, just over 10 per cent.

But here, again, no division is made between the operations for intrinsic and extrinsic disease, a distinction which in this country is looked upon as of vital importance, and the great difference in the earlier and later cases is not emphasized.

Thus, 6 of the 8 successful operations were performed during or after 1888, and the 6 contained three of Butlin's and one of Semon's, so that these two are responsible for one-half of the total 8 successful cases. Reference has already been made in treating of the mortality of thyrotomy for malignant disease to the number of cases performed by Butlin and Semon up to July, 1896. Their results since then have been even better. For instance, Semon states (*British Medical Journal*, November 28, 1903): 'I can now summarize my results to the effect that out of 18 cases of undoubted malignant disease of the larynx which I have operated upon by thyrotomy between June 2, 1891, and July 29, 1902, 15—that is, 85 per cent.—were permanently cured. Three of these patients died several years after the operation from affections altogether unconnected with the original disease, one six years after from an acute abdominal affection; the second, three years and a quarter after the operation from embolism of the heart or the lungs; the third, four years after operation from pneumonia. The remaining 12 are now alive and well, whilst the vocal results, with the exception of a few cases in which it was necessary to remove both vocal cords, are surprisingly good.'

It is difficult to lay down any strict rule as to the period that should elapse subsequent to operation for the term 'cured' to be used. In Sendziak's work all cases under three years from operation are spoken of as 'relative cures,' and all cases free from disease three years or more subsequent to operation as 'permanent or definite cures.' Semon considers a case to be cured that is free from any recurrence one year after operation, and states that it has been his experience that recurrence takes place within a year of operation or not at all. His published cases, with their results, seem to bear out his views.

The results obtained by Butlin and Semon are due to early diagnosis and limitation of the operation most rigidly to suitable cases, selected by virtue of their being of intrinsic origin and limited in extent.

It is of the greatest importance to operate early in these cases, and thus it has fallen to their lot to have to open the larynx in more than one case in which there was a doubt as to the nature of the disease, and the diagnosis could not be cleared up by the removal of a fragment through the mouth for microscopical examination. When the disease has been found to be of an innocent nature the larynx has been closed at once, and no evil has resulted. On the other hand, they have perhaps erred somewhat in declining to operate in advanced cases of carcinoma of the larynx, and have very infrequently operated for carcinoma of extrinsic origin.

Of the table of 110 *partial laryngectomies* put together by Sendziak, he finds 10 cases which he

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claims as successes, but the total may be reduced by deducting some 14 or 15 cases in which the observation of the case lasted less than a year, or the patient died within three years of some other cause than carcinoma of the larynx and glands. The proportion of successes is, therefore, even after this deduction, very small, about the same as was obtained by the operation of thyrotomy. It is here of great importance to examine the class of cases in which success was obtained. Seven of the cases were certainly of intrinsic origin and only one of them certainly extrinsic, while in the two remaining cases the disease was probably, but not certainly, intrinsic.

By the exclusion of the same kind of cases as have been excluded in considering the table of partial laryngectomies, the 188 *total laryngectomies* of Sendziak may be reduced to about 170, and there are eleven successes to be claimed. Among the excluded cases it is wonderful how many are to be excluded on account of death from pneumonia or bronchitis within three or four months of the operation. The proportion of cured cases is lamentably small, while the mortality of the operation is extremely large. It is very difficult in most of the successful cases to come to any conclusion as to the extent or origin of the disease, but it appears generally to have been very extensive, and is more than once spoken of as filling the cavity of the larynx.

On the other hand, the description of the disease in many of the 188 cases inclines one to the belief that total laryngectomy was a much larger operation than was necessary, and that the conditions of the

case might well have been met by partial laryngectomy or even by an extensive thyrotomy.

As might be expected, the ultimate results of the cases during and since 1888 are somewhat better than those of the cases before that date. It has already been shown that the death-rate due to the operation is less, and of the 56 patients alive and free from disease, 4 were alive and free from recurrence more than three years after the operation.

That the results, both as regards recurrence, cure, and mortality following total laryngectomy, have been steadily improving of late may be proved by the following tables of comparison :

	Sendziak's Tables (188 Cases).	Schmiegelow's Tables, 1890-1897 (50 Cases).
	Per Cent.	Per Cent.
Mortality - - -	44'7	22
Recurrence - - -	32'45	20
Relative cure (less than three years) - - -	6'9	48
Definite cure (three or more years) - - -	5'85	10

The results, however, obtained by Professor Gluck, of Berlin, and described by him at the British Medical Association's meeting at Swansea, July, 1903, are most surprisingly brilliant, and hold out the greatest hope for the future. He stated he had performed 35 hemilaryngectomies with only 3 deaths, one twenty-four hours after operation from sudden heart failure, one from phlegmon of the right gluteal muscle, and one from pneumonia on the fifth day.

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He also had performed 22 total extirpations of the larynx with *one* death, this being in an old man of seventy, who succumbed to iodoform poisoning the eleventh day after operation.

He also performed 27 transverse extirpations of the larynx, pharynx, and glands, with again only 1 death. He furthermore pointed out that in a former series of 9 cases he had had 4 deaths; and going back to 1888 and the first cases, there had been only 2 recoveries out of 10 operations.

Professor Gluck said he could have brought forward 38 of his patients, some of whom had survived operation 11, 8, $6\frac{1}{2}$, $5\frac{1}{2}$, $4\frac{1}{2}$, and $3\frac{1}{2}$ years, and were in full health.

Are Patients who are not cured relieved by the Operation?—Patients on whom the operation of thyrotomy or partial extirpation of the larynx has been performed are generally quite comfortable in all respects. They are not obliged to wear a tube, can swallow well, and can speak sometimes exceedingly well, and at all times in a gruff whisper. So long, then, as there is no recurrence of the disease, they are absolutely relieved by the operation, but the voice, of course, is not as a rule improved by the operation, although it may be quite as good after it as it was for some time previously.

On the other hand, patients who have undergone total extirpation of the larynx, especially when the operation has been extended into the neighbouring soft parts, are often in quite a miserable condition. In some there is great difficulty in swallowing. All of them need to wear a tracheotomy tube unless the

trachea is fastened to the opening in the skin ; and the artificial larynx is much more troublesome to wear and manage than is usually thought. Furthermore, there is no doubt that these patients are much more liable than other persons to pneumonia and other affections of the lungs.

Conclusions.

Endolaryngeal operations are only indicated in very exceptional circumstances. The disease must be very limited in extent, and quite superficial, and even then endolaryngeal removal should only be adopted in those cases in which there are very urgent reasons against opening the larynx, or in which the patient refuses a major operation.

Thyrotomy is *the* operation for all cases of intrinsic carcinomas in which the disease is limited to the interior of the larynx. It is but seldom necessary in such cases to remove any of the framework of the larynx except when the disease is situated at the posterior part of the larynx.

It is quite sufficient to scrape or cut away the superficial part of the cartilage beneath the base of the disease.

Thyrotomy, according to the experience of English laryngologists, is a safer and more satisfactory operation than the various modifications of pharyngotomy for the removal of cancer of the epiglottis and ary-epiglottic folds, etc.

It permits of a more thorough exposure of the disease and of greater certainty in dealing with it,

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and it, moreover, seems to be less dangerous to life.

Partial excision of the larynx, either of one-half or an atypical operation adapted to the extent and character of the disease, is suitable to cases in which the disease, although of intrinsic origin, is of greater extent than could be dealt with satisfactorily by thyrotomy and removal of the soft parts.

It is also indicated in those cases in which rapid recurrence has followed a carefully executed thyrotomy, and in cases of extrinsic origin limited to one-half of the larynx.

Total extirpation of the larynx has been but seldom performed in this country, and has been losing favour in other countries. If the extent of the disease be so great that partial laryngectomy will not suffice, the prospect of success from an operation has been hitherto deemed bad. The patient is much more liable after it to pulmonary affections, particularly to fatal pneumonia, and the mutilation caused by the operation is often so considerable that the patient's lot is a very sad one. At the same time, the results obtained by Gluck, and already referred to, point to the fact that total laryngectomy can be performed with excellent immediate and remote results, and should go a long way towards popularizing an operation hitherto exceedingly unpopular, at all events in this country.

The operations that are suitable for the removal of carcinoma are equally suitable for the removal of sarcoma.

Glandular infection occurs late in cancers of

intrinsic origin, especially when attacking the anterior two-thirds of the true vocal cords or the false vocal cords; it occurs equally early in cancers of extrinsic origin. It is probably sound surgery to remove the glands liable to infection, whether enlarged or not, in all cases of laryngeal cancer excepting those attacking the anterior two-thirds of the true vocal cords or the false vocal cords, in which situations experience has proved that glandular infection but rarely occurs, and then only at a late stage of the disease.

The most promising cases of carcinoma for operation are those in which the disease is situated on the anterior two-thirds of the true vocal cords or on the false vocal cords, is small in extent and not deeply fixed. And the best patients are those who otherwise are in good health, and particularly those who are not liable to bronchitis. Sarcomas of small size and of intrinsic origin are probably equally promising for operation.

Carcinomas of extrinsic origin are always much less favourable for operation. The actual removal of the disease is more dangerous to life, while the greater local malignancy of the disease and the early tendency to infection of the lymphatic glands render the prospect of cure poor.

Palliative Measures.

It appears, from a consideration of the cases which have been treated by palliative measures only, that the life of a patient suffering from carcinoma of the

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larynx may last as long as two, three, and even, though rarely, more years; and life may often be prolonged and rendered far more comfortable and the end more easy by the timely performance of tracheotomy. Tracheotomy is therefore indicated in those cases of laryngeal cancer which are considered inoperable and in which there is increasing dyspnoea.

Fauvel gives some statistics from his own practice showing the utility of this operation as a palliative measure. His statistics show that in 7 patients on whom tracheotomy was performed for carcinoma of the larynx the average duration of life was four years, whereas in 6 patients suffering from a similar condition, and in whom no operation was performed, the average duration of life was twenty-one months.

Dr. Solis Cohen, in a paper* on excision of the larynx, speaks thus of tracheotomy in carcinoma: 'Of a number of cases of carcinoma of the larynx under my own care who agreed to submit to resection of the larynx should I so determine, and in whom I performed tracheotomy in preference, 1 lived six months, 2 lived seven months, 1 lived thirteen months, and 1 eighteen months respectively after the tracheotomy. Had laryngectomy been practised in these five cases with equal tenure of existence, the result would have been accredited to the radical procedure.' If tracheotomy be performed the low operation should be chosen.

Constitutional treatment holds out no hope of

* 'Does Excision of the Larynx tend to Prolongation of Life?' p. 18. Philadelphia, 1883.

cure. Serum-therapy has been given an extensive trial, but unfortunately there is nothing so far to be said in favour of it as a curative agent. The same applies to the employment of the X rays, radium, etc. In inoperable cases pain, if present, must be relieved by the insufflation of morphine, $\frac{1}{8}$ to $\frac{1}{2}$ grain, or the local application of a solution of cocaine (10 to 20 per cent.). Insufflations of orthoform are also much in vogue at present.

When there is much ulceration and fœtor, inhalations of creosote or benzoin are useful and soothing, or a powder of iodoform gr. i., ac. borici gr. i., morph. hydrochlor. gr. $\frac{1}{8}$, cocaine gr. $\frac{1}{8}$, may be used for insufflation. It is necessary to warn the patient against the use of tobacco and strong spirits.

Should there be pain in swallowing, it may become necessary to adopt rectal feeding. The passage of œsophageal tubes is contra-indicated in these cases, but, if employed, Symonds' tube is the most useful.

SARCOMA OF THE LARYNX.

Sarcoma as affecting the larynx is of infinitely less frequency than carcinoma. In olden days its differentiation from cancer of the larynx did not exist, and it has been only during the last thirty years that sufficient attention has been given to the differential diagnosis and the two diseases clearly recognised. According to Sendziak, the first case of primary sarcoma of the larynx to be met with in medical literature was published by Broadbent in 1861.

Since then many observers have worked at and written on the subject. Bergeat, of Munich, has collected from various sources 114 cases of sarcoma affecting the larynx and trachea, and various authors have referred to the subject in their works on diseases of the larynx (Mackenzie, Von Ziemssen, Schrötter, Massei, Gottstein, etc.).

In Butlin's monograph on 'Malignant Disease of the Larynx' (1883), the number of cases of sarcoma affecting the larynx collected from various sources amounted to 23, and in Sendziak's recent work on 'Malignant Disease of the Larynx' statistics are given of 50 cases of sarcoma.

ETIOLOGY.

The etiology of sarcoma of the larynx is practically unknown. Occupation does not seem to have exercised any marked influence in the production of the tumours, but the great preponderance of males among the patients—in Sendziak's tables of 50 cases, 31 males, 13 females; in Bergeat's, 48 males, 18 females—may suggest that strong and over use of the voice, with perhaps tobacco-smoke and other irritants, play a part in the etiology of sarcoma. Bergeat refers to the fact that in many of the cases collected by him the patients were more or less connected in their work with horses, and both he and Von Esmarch believe syphilis to be a strong predisposing agent.

In some instances sarcomatous tumours of the larynx have been attributed to severe colds.

Frequency.—As already stated, sarcoma is infinitely more uncommon than carcinoma of the larynx, the proportion of cases being variously put at 1 to 11 or 12, 1 to 17-25 (Schmidt).

Mackenzie, in his practice, out of 53 cases of malignant tumours, only met with it in 5, and Semon 3 times out of 103 cases of malignant disease of the larynx; Massei, out of 200 similar cases, 6 times.

Again, in relation to sarcoma occurring in other parts of the body, it is found that the larynx is a rare organ to be attacked. Gurlt, out of 848 cases of sarcoma, noted the presence of one solitary case in the larynx.

Age.—Age does not play so important a part as in

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carcinoma. Sarcoma is frequently met with at an earlier age than carcinoma, as the following analysis of Sendziak's 50 cases shows :

Years.				Cases.
7	-	-	-	1
13	-	-	-	1
18	-	-	-	1
19	-	-	-	1
Between 21 and 30	-	-	-	6
„ 31 and 40	-	-	-	6
„ 41 and 50	-	-	-	10
„ 51 and 60	-	-	-	13
„ 61 and 70	-	-	-	2
74	-	-	-	2
				<hr/>
				43
Not noted -	-	-	-	7
				<hr/>
				50

The youngest of the patients was, accordingly, 7 years of age, the oldest 74 (Semon has met with a case in a man of 81), but in the first case the disease was believed to be congenital.

Bergeat's statistics give :

Years.			Cases.
Between 20 and 30	-	-	6
„ 30 and 40	-	-	11
„ 40 and 50	-	-	13

From 40 to 60 may be said to be the commonest age for sarcoma of the larynx. In women it has been noted most frequently from 30 to 50 years of age, and in men from 50 to 60.

In those over 60 years of age the male sex preponderates (Lange 74, Semon 81).

Situation.—As in carcinoma, sarcoma of the larynx can best be classified as (1) *intrinsic*, (2) *extrinsic* in origin.

In 23 cases collected by Butlin in 1883, 17 were intrinsic, 3 extrinsic, and 3 of uncertain origin.

In Sendziak's 50 cases, 26 were of intrinsic and 15 of extrinsic origin, and 9 not noted.

In some of the cases the whole of the interior of the larynx was occupied by the disease, but where the seat of origin could be distinguished, it was for the large majority of the intrinsic sarcomas the true vocal cords or the ventricular bands, of the extrinsic sarcomas the epiglottis.

Taking the two classes together, the order of frequency may be said to be, first, the true vocal cord, next the epiglottis, then the false vocal cord, and more rarely the posterior part of the larynx and ventricle of Morgagni.

As in carcinoma, it is very rare to find the sinus pyriformis the original seat of growth. It is of importance to remember that the disease may be infraglottic; Sendziak reports 6 such cases out of his series of 50 sarcomas of the larynx.

Apparently, the left half of the larynx is more frequently attacked than the right, and there is no reason known why this should be so. Sarcoma of the larynx may be primary or secondary in origin. In 97 cases noted by Bergeat 85 were primary and 12 secondary, the latter mostly arising from continuity of tissue, and but very rarely from metastasis.

In connection with the subject of metastasis, it is

to be noted that out of the 50 cases already referred to (Sendziak's) of laryngeal sarcoma there was but 1 case (Table VII., Case 6) in which post-mortem examination revealed a secondary growth (in the lung).

Rollier, however, has reported a case of sarcoma of the larynx with secondary growths in the lungs, liver, and brain, and Koschier one in which lymphosarcoma of the breast, sternum, mediastinum, pleuræ, glands, pharynx, and larynx was found.

Out of the 23 cases collected by Butlin the number of complete autopsies was only 2; in neither of them were secondary tumours found, nor were there any signs which denoted the formation of secondary tumours in any of the patients before death. He therefore stated: 'A more extended series of observations may show that secondary growths are not uncommon, but the evidence at present before us seems to prove that sarcoma of the larynx neither affects the lymphatic glands nor produces secondary growths, and that its malignant properties are limited to infiltration of adjoining parts.' These views were expressed in 1883, and not only does further experience prove the rarity of secondary growths, but also that involvement of the glands in the neighbourhood is the exception and not the rule.

Out of Sendziak's 50 cases only 3 are mentioned in which the glands were affected—namely, Table V., Case 4. A man aged fifty-one with a round-celled sarcoma under the left vocal process. Laryngo-fissure and excision of the affected glands was performed with good results (Bessel and Hagen).

Table VI., Case 8.—A male aged fifty-seven with

a round-celled sarcoma affecting the right processus vocalis. The right half of the larynx and the affected glands were removed. Death ensued three days later from coma (Gluck).

Table VII., Case 2.—A male aged forty-six with ulcerating lympho-sarcoma of the base of the epiglottis. Total laryngectomy and excision of the affected glands was performed. Death ensued fifteen months later from recurrence (Czerny).

The absence of glandular affection in sarcoma of the larynx has been clearly recognised by most of those who have written on the subject, and is a matter of great importance, both from a pathological and clinical point of view.

Reference has already been made to the distribution of the lymphatic vessels of the larynx in treating of carcinoma of that organ, and it can scarcely be maintained that the absence of lymphatic vessels is the reason why sarcomas do not affect the lymphatic glands. The extrinsic parts of the larynx at all events are very amply provided with lymphatics, and it has been already pointed out that carcinoma of these parts affect the lymphatic glands at an early period; yet sarcoma affecting these same parts does not lead to glandular involvement or secondary growths. They, however, give evidence of their malignant properties in the manner in which they infiltrate the tissues, and in the obstinacy with which some of them recur after what appears to be complete removal.

Taking now the microscopical characters of the various sarcomata of the larynx met with, it is found

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that in nearly half the cases the tumour was spindle-celled, or composed of cells closely resembling the typical spindle cell. Included in this variety are the cases described as fibro-sarcomata. Next in frequency come the round-celled tumours, and finally alveolar sarcoma.

The following varieties have also been noted by various authors, but are all of exceptional rarity : sarcoma carcinomatodes, myeloid, chondro-, angio-, adeno-, lympho-sarcoma, melanotic and papillary sarcoma. In many cases recorded the tumours are merely said to be 'sarcomas.'

Szmurlo has described a very interesting case of mixed cancer and sarcoma of the larynx.

CLINICAL VARIETIES AND SYMPTOMS.

Sarcoma of the larynx presents itself clinically in very varied forms, according to the time the disease has been in existence. It always forms a definite tumour, generally diffuse in character, and with a broad base arising from the true or false vocal cord, epiglottis, or aryepiglottic fold. It is uncommon to find it presenting itself as a circumscribed tumour of a polypoidal type, and in those cases partaking of this character the origin has been almost invariably the true vocal cord.

The tumour seldom grows to a large size, the largest examples only attaining the size of a walnut or a little larger.

The mucous membrane covering the tumour is

generally discoloured, the character of the discoloration varying considerably, some of the tumours being much paler than the normal mucous membrane, others much darker, either deep red or livid, and traversed by large full vessels.

In shape the neoplasm is generally round, with a variable surface. The latter may be smooth, uneven, or wart-like. Mackenzie noted a wart-like appearance in 4 out of his 5 cases.

Sooner or later infiltration invariably takes place. In the worst cases the tumour, being of extrinsic origin, has grown into the base of the tongue or wall of the pharynx; or, being of intrinsic origin, has extended through the membranes or the thyroid cartilage into the hyoid muscles.

One of the most characteristic features of laryngeal sarcoma is the absence of ulceration. When ulcers are seen they are generally small and superficial. As in carcinoma, perichondritis, with all its after-effects, may occur.

Most of the tumours feel firm or hard when examined with the laryngeal probe, although Schmidt is of a different opinion. Bergeat noted 15 cases as hard and 13 as soft. In a few cases the tumour has been of mixed consistency—hard at the base and soft at the apex. As a rule, the growth is solitary, although in a few rare cases two or more growths have been present either close together or separated by a narrow interval, while in one instance two growths were attached to the two vocal cords, and were separated by a narrow chink of glottis (Schnitzler-Krajewski).

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The course of the disease is certainly more rapid than in carcinoma, especially in cases of so-called alveolar sarcoma. Burow has recorded an example in which the tumour, which grew from the posterior aspect of the epiglottis, was as large as a small walnut when an attempt was made to remove it six weeks after the symptoms were first noticed. It was a spindle-celled sarcoma.

Symptoms.

The symptoms of sarcoma affecting the larynx are very similar to those of simple laryngeal tumours. One of the earliest symptoms is hoarseness or some slight affection of the voice, although this is much less frequent and marked than in carcinoma.

Pain, especially in the early stages, is absent, or only slight, though it may become more marked later on. At all events, it is invariably much less intense than in carcinoma. There may be a feeling as of a foreign body in the throat, and the patient may suffer from impeded respiration, and, as the glottis becomes narrowed, stenosis may become well marked.

Dysphagia, especially in sarcoma attacking the epiglottis, is often present, and may sometimes be very severe.

Secretion is usually insignificant; if ulceration be present it may be blood-stained.

As already stated, the neighbouring glands are in most instances not affected, although they are liable to become involved in the later periods of the disease.

Even in the later stages, however, the glands usually escape infection.

Limited movement of the cords may be present or absent, although, according to some laryngologists, this symptom has not the same significance as in carcinoma.

Diagnosis.

Before a course of treatment which may be deemed suitable to any given case can be pursued, a correct diagnosis of the nature of the tumour must be made.

In some instances it may be easy to decide that a certain tumour is sarcomatous, but this is not at all the rule. It is usually very difficult to distinguish from the objective symptoms or from the external characters of the tumour between sarcoma and carcinoma on the one hand, between sarcoma and innocent tumours on the other hand. It is also difficult to diagnose in certain cases between sarcoma and gummatous deposits or syphilitic perichondritis.

The external characters of the tumour, although they may lead to the suspicion that the disease is malignant and yet not carcinoma, can seldom be implicitly relied on. The absence of ulceration has already been alluded to, but ulceration may be absent in carcinoma, and is generally absent in non-malignant tumours.

Fortunately, however, the diagnosis, which might seem from what has just been said to be so difficult, may easily be made in almost every case by comparatively simple means. A portion of the tumour may be removed with the cutting laryngeal forceps, and

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be subjected to microscopical examination. Tumours of the epiglottis and extrinsic portions of the larynx may be treated in this way with scarcely any difficulty; tumours of the ventricular bands and vocal cords with greater difficulty, of course, but with a difficulty which depends largely on the size and exact situation of the tumour. It must be understood that the fragment thus removed be subjected to a searching microscopical examination, and that several sections of the fragment removed be made. It is important to examine all parts of the excised fragment, especially its base. The removal endolaryngeally of even a large fragment is productive of scarcely any pain, and so far from being dangerous, has often afforded marked temporary relief.

Prognosis.

Sarcoma of the larynx, compared with carcinoma, offers a much more favourable prognosis, both with regard to life and tendency to recurrence. In comparison with innocent tumours the prognosis is a great deal worse.

The tendency of the disease is to cause death from suffocation or exhaustion, and this may take place within a year or eighteen months of the first appearance of the disease. Usually, however, the course of the disease is much slower, and the patient may live for two, three, or more years.

Treatment.

It is hardly necessary to mention that the only rational treatment for laryngeal sarcoma is operative. Palliative treatment may demand tracheotomy, and in some cases Coley's fluid (toxin of *Streptococcus erysipelatosus* and *Bacillus prodigiosus*) has been injected, but with no good results.

Such measures as the employment of the galvanocautery, the use of caustics, etc., should be strongly condemned, for they merely stimulate the activity of the growth.

The operative measures that have been employed for the removal of sarcoma of the larynx are as follows:

1. Endolaryngeal Removal.
2. Suprathyroid Laryngotomy.
3. Infrathyroid Laryngotomy.
4. Thyrotomy.
5. Partial Extirpation of the Larynx.
6. Total Extirpation of the Larynx.

(1) **Endolaryngeal Removal.**—If mere removal with endolaryngeal forceps *per vias naturales* be considered, few, if any, complete recoveries can be claimed. In the section of his work which is devoted to sarcoma Mackenzie spoke hopefully of the endolaryngeal method, and stated: 'In one case I succeeded in permanently removing the growth *per vias naturales*, and Navratil, Gottstein, Türck, and others have effected cures in this way.' This was in the year 1881.

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Now, on examining these references of Mackenzie's, we find that in only one case, that of Gottstein's, was a permanent cure effected. The patient was a boy aged seven, suffering from a fibro-sarcoma of the vocal cord; the tumour was removed with a snare, and thirteen years later the boy was still well and his voice good.

In Navratil's case the diagnosis was not confirmed microscopically, and the later history of the case is unknown.

In Türck's case, a round-celled sarcoma of the left vocal cord, the subsequent history is also unknown.

Taking Sendziak's series of cases, we find he has collected 13 in which endolaryngeal removal was performed.

Of actual cures—that is to say, longer than three years without recurrence—there is only 1 case, namely, that of Gottstein's, already referred to.

Of relative cures—that is to say, no return up to one year after—2 cases.

Of recurrences 5 cases (*i.e.*, from two to eight months). Results uncertain, 5 cases.

What has already been said as to the limitation of this method of operation with regard to carcinoma of the larynx holds equally good in connection with sarcoma. Only in those suffering from extreme old age or grave impairment of the health should this method be attempted.

(2) **Suprathyroid Laryngotomy.** — The number of cases in which suprathyroid laryngotomy has been performed is too few to be able to judge the value of the operation.

It has been performed for the removal of growths situated at the upper opening of the larynx, particularly in connection with the epiglottis.

Burow, for instance, has described the case of a man thirty years of age who suffered from a spindle-celled sarcoma of the epiglottis. It was removed with forceps and cautery, a little later with the steel loop, and again a few days later with a sharp spoon and scissors, after a free incision had been made in the sublingual region. Eighteen months after the last operation the patient was quite well. This is the more remarkable because the original tumour had grown very rapidly, and recurrence had taken place almost immediately.

(3) **Infrathyroid Laryngotomy.**—What has already been said as to the indications and value of this operation as applied to carcinoma of the larynx equally applies to sarcoma of the larynx.

(4) **Thyrotomy or Laryngo-fissure.**—The first case, apparently, in which thyrotomy was performed for sarcoma of the larynx is mentioned by Laroyenne. The patient was a woman suffering from a spindle-celled sarcoma of the right vocal cord, which had been growing for about twelve months. It was removed after division of the thyroid cartilage. Eight months after the operation she was free from disease.

Sendziak has collected 12 cases of sarcoma in which thyrotomy was performed. Two of the 12 patients were well and free from disease, 1 four years after the operation, and the other nearly five years after it was performed. This, therefore,

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insures 2 thoroughly successful cases out of the total of 12.

None of the other patients can be claimed to have been cured, but 4 of them were well two years, or nearly two years, after the operation, and 2 other patients were well a year after the operation. There were 2 cases, also, in whom too short a period had elapsed since the operation to judge of the results, while recurrence of the disease was only noted in 2 of the 12 cases.

In no case was there a fatal issue from the operation itself, and the phonatory results were as good as the general results.

(5) **Partial Laryngectomy.**—In Sendziak's tables there is a series of 10 cases recorded in which partial laryngectomy was performed for sarcoma.

The results are very different from those following thyrotomy.

One patient was free from recurrence four years after the removal of a round-celled sarcoma of the left true and false cords (Bull, of America). Three died of lung mischief (apparently non-malignant) at periods of three months, twelve months, and eighteen months after the operation, and without any sign of recurrence of the disease. One patient suffered from immediate recurrence of the disease, and Küster successfully removed the whole of the larynx. Another patient died of recurrence two and a half years after operation. Three patients died as a result of the operation, 2 on the third day from coma, and 1 from pneumonia. The remaining patient was still well about a year after the operation.

(6) **Total Extirpation of the Larynx.**—An analysis of Sendziak's 11 cases furnishes really better results.

There were 3 cases of definite cure, 1 patient being quite well seven, another eight, and yet another fifteen years after the operation. Of the remaining 8 cases, however, it is found that 4 died of recurrence of the disease five months, seven months, one year, and fifteen months respectively after the operation, and 3 as a result of the operation, while in 1 case the time that had elapsed since operation was too short to be able to judge of the result.

The results, therefore, of the 33 operations included under thyrotomy, partial and complete laryngectomy, can hardly, from any point of view, be called good, yet they are not wholly bad, because, in addition to the really successful cases, there are several in which there is reason to hope that the result proved quite successful.

The successful laryngectomies were performed for three varieties of sarcoma, one round and spindle-celled, the second lympho-sarcoma, and the third 'sarcoma carcinomatodes.'

The results of these various operations for sarcoma of the larynx, when compared together, work out as follows :

		Per Cent. of Good Results.
1. Thyrotomy (best measure)	-	- 58'3
2. Total laryngectomy	-	- 36'3
3. Partial laryngectomy	-	- 30
4. Suprathyroid laryngotomy	-	- 25
5. Endolaryngeal removal	-	- 23

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By good results are understood the cases of definite as well as relative cures.

If we take the *definite cures* by themselves the results work out as follows :

			Per Cent.
1. Total laryngectomy	-	-	- 27'3
2. Partial laryngectomy	-	-	- 10'0
3. Thyrotomy	-	-	- 8'3
4. Endolaryngeal removal	-	-	- 8'0

The *relative cures* give :

			Per Cent.
1. Thyrotomy	-	-	- 50
2. Partial laryngectomy	-	-	- 20
3. Endolaryngeal removal	-	-	- 15
4. Total laryngectomy	-	-	- 9

Now, taking the *bad results* as regards (a) recurrence, (b) fatal results, we find :

(a) *Recurrence.*

			Per Cent.
Endolaryngeal	-	-	- 38'5
Partial laryngectomy	-	-	- 20
Total laryngectomy	-	-	- 18
Thyrotomy	-	-	- 16'6

(b) *Fatal Results (within Two Weeks of the Operation).*

			Per Cent.
Partial laryngectomy	-	-	- 80
Total laryngectomy	-	-	- 27'3

There have been no fatal results at all from thyrotomy or endolaryngeal operation.

Where total laryngectomy is indicated, the results apparently are better than in similar conditions for carcinoma of the larynx.

The treatment of sarcoma of the larynx is thus in most instances clear.

When the disease is of intrinsic origin, limited in extent, especially to one cord or ventricular band, thyrotomy should undoubtedly be performed. Similarly, thyrotomy is indicated after recurrence following the endolaryngeal method (this latter method should, however, only exceptionally be advised), and also as a preliminary diagnostic step to laryngectomy. When, after thyrotomy, the disease recurs and exhibits signs of more extensive infiltration, or when from the first it presents a much more formidable appearance—in those instances, for example, when the entire larynx seems filled by a sarcomatous tumour, the attachments of which are evidently deep-seated and widely extended—the question of removal of the larynx, either partial or complete, will naturally be raised.

If the patient be not too old or weak for so severe an operation, and if it be certain that the disease can be entirely removed, especially if it be limited to the interior of the larynx, and that at the same time thyrotomy will not meet the case, then extirpation, partial or complete, of the affected organ is indicated.

The question very naturally arises how far the removal of the larynx contributes to a fatal issue from pulmonary disease. Out of Sendziak's 21 cases a fatal issue from lung trouble occurred in 4 patients; 1, three months after operation, from pneumonia; 2 from pleuritis, twelve and fifteen months respectively after operation; and 1 from tubercle, eighteen months subsequent to removal of the larynx. Of deaths from the operation itself there are 5 cases,

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and of these 3 were from pneumonia and 2 from coma.

There can therefore scarcely be a doubt that removal of the larynx, either partial or complete, must increase the liability to pulmonary affections, immediate or remote.

This, however, should not contra-indicate the performance of the operation whenever it is clearly indicated in cases of sarcoma. Improved methods of operation have of recent years tended to lessen these liabilities, and it must be remembered that death from an acute or even tolerably chronic pulmonary disease is in most instances preferable to death from obstruction of the larynx and its attendant evils when the obstruction is due to a sarcomatous tumour.

Contra-indications to the operation (partial or complete laryngectomy) are general bad condition of the patient, too extensive growth, affection of the neighbouring parts—*i.e.*, pharynx, etc.—and, lastly, tubercle of the lungs.

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